PB-230 681

RECREATION AND FISHERY VALUES IN THE SAN FRANCISCO BAY AND DELTA

E. G. Altouney, et al

Stanford Research Institute
Menlo Park, California

7 October 1966

DISTRIBUTED BY:

NTIS
National Technical Information Service
U. S. DEPARTMENT OF COMMERCE
5285 Port Royal Road, Springfield Va. 22151

PB 230 681

STANFORD RESEARCH INSTITUTE
MENLO PARK, CALIFORNIA

October 7, 1966

RECREATION AND FISHERY VALUES IN THE SAN FRANCISCO BAY AND DELTA

Prepared for:

DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
CENTRAL PACIFIC RIVER BASINS
COMPREHENSIVE WATER POLLUTION CONTROL PROJECT
ALAMEDA, CALIFORNIA 94501

By: E. G. ALTOUNEY, L. J. CRAMPON, AND G. E. WILLEKE

SRI Project 5838

Reproduced by
NATIONAL TECHNICAL
INFORMATION SERVICE
U S Department of Commerce
Springfield VA 22151

175

PREFACE

The present study was conducted for and at the request of the Central Pacific River Basins Comprehensive Water Pollution Control Project of the Federal Water Pollution Control Administration.

The Institute wishes to acknowledge the cooperation of local, state, and federal agencies in the compilation of data for this study. Consultations with prominent experts in the field of recreation economics were held throughout the period of study. Special thanks are due Allen V. Kneese and Jack L. Knetsch of Resources for the Future for their comments on the estimates of recreation use and unit values of economic benefits of recreation.

Edward G. Altouney, civil engineer in the Institute's Public Works Systems Group, served as Project Leader for the study. He was responsible for the method of approach used in the study and the organization and conduct of the research, and he contributed to all sections of the report.

Louis J. Crampon, industrial economist, was responsible for the detailed estimates of recreation use except for fishing. He also wrote the corresponding sections of the report.

Assistance in the sport and commercial fishery sections of this report was provided by Mr. John E. Skinner who acted as a consultant to Stanford Research Institute while simultaneously conducting a related study entitled "Estimates of the Use and Harvest of Fish and Wildlife Dependent on San Francisco Bay and the Delta." The latter resulted in a State of California Department of Fish and Game report, dated June 1966, prepared for the FWPCA.

Gene E. Willeke, research analyst, assisted in the detailed computations of economic benefits and in the drafting of several sections of the report.

Mr. Albert R. Blanch, FWPCA Regional Economist, served as Project Officer for the study. His assistance and cooperation as well as those of Mr. James C. McCarty, Deputy Director of the Central Pacific River Basins Project, are gratefully acknowledged.

Preceding page blank

CONTENTS

PREFACE iii

I INTRODUCTION 1

II SUMMARY AND CONCLUSIONS 5

PART 1 ESTIMATES OF RECREATION USE OTHER THAN FISHING AND HUNTING 11

III APPROACH TO ESTIMATES OF RECREATION USE 13

- Potential Demand for Selected Recreation Activities . . 16
- Estimates of Total Expected Use in the Study Area . . . 17

IV POTENTIAL DEMAND OF 11-COUNTY AREA RESIDENTS 19

V POTENTIAL DEMAND OF ALL OTHER CALIFORNIA RESIDENTS . . . 35

VI POTENTIAL DEMAND OF ALL OTHER U.S. RESIDENTS 41

VII TOTAL POTENTIAL DEMAND OF ALL GROUPS 51

VIII TOTAL EXPECTED USE IN THE STUDY AREA 53

- Sunbathing and Swimming 54
- Sightseeing 59
- Boating 62
- Water Skiing 69
- Picnicking 73
- Nature Walking 75
- Camping 78
- Hiking 81
- All Activities 83

IX PRESENT RECREATION USE BY ACTIVITY, REGION, AND TYPE OF PARTICIPANT 87

X BREAKDOWN OF PROJECTIONS BY ACTIVITY, REGION, AND TYPE OF PARTICIPANT 91

Preceding page blank

CONTENTS

PART 2 ESTIMATES OF FISHING AND HUNTING 105

XI SPORT FISHING 107

King Salmon 109
Steelhead Trout 110
Striped Bass 111
Sturgeon 112
American Shad 112
Miscellaneous Bay Angling 113
Catfish 114
Largemouth Black Bass 115
Unidentified Delta Angling 115

XII COMMERCIAL FISHING 117

XIII WATERFOWL HUNTING 119

PART 3 EVALUATION OF ECONOMIC BENEFITS 121

XIV METHOD OF COMPUTATION 123

Procedure 123
Selected Method and Justification 123
Calculation of Discounted Future Benefits 126

XV SUMMARY OF BENEFITS 133

XVI BIBLIOGRAPHY 163

APPENDIXES

A POSSIBLE DEVIATIONS FROM MEDIAN PROJECTIONS 167

B POPULATION PROJECTIONS 175

ILLUSTRATIONS

1 San Francisco Bay and Delta 3

2 Breakdown of Recreation Use in Study Area 6

3 Total Recreation Use for All 10 Activities in Study Area, by Type of Participant 7

4 Potential Demand for Recreation Activities Based on Assumption of No Limitation in Supply of Facilities, and Expected Recreation Use 8

5 Annual Economic Benefits of Recreation Activities--San Francisco Bay and Delta 9

6 Total Recreation Use, by Type of Participant and Type of Recreation Activity 86

7 Percentage of Total Recreation Use in Study Area, by Type of Participant 103

8 Economic Benefits of Recreation Activities--San Francisco Bay and Delta 127

9 Economic Benefits of Recreation Activities--South San Francisco Bay 128

10 Economic Benefits of Recreation Activities--Central San Francisco Bay 129

11 Economic Benefits of Recreation Activities--San Pablo Bay . 130

12 Economic Benefits of Recreation Activities--Suisun Bay . . . 131

13 Economic Benefits of Recreation Activities--Delta 132

14 Economic Benefits of Commercial Fishing--San Francisco Bay . 160

15 Annual Net Economic Benefits of Commercial Fishing 161

16 Median Population Projections for the 11-County Area 178

TABLES

1 Summary of Approach to Estimates of Recreation Use 14

2 Annual Per Capita Potential Demand of 11-County Area Residents for Selected Recreation Activities 20

3 Annual Per Capita Potential Demand of 11-County Area Residents for Selected Recreation Activities, Based on Income and Urbanization Forecasts 23

4 Annual Per Capita Potential Demand of 11-County Area Residents for Selected Recreation Activities, Based on Projection of 1950-1980 Demand 24

5 Final Estimates of Annual Per Capita Potential Demand of 11-County Area Residents for Selected Recreation Activities 26

6 Total Annual Potential Demand of 11-County Area Residents for Selected Recreation Activities, Based on Median Population Projections 27

7 Projections of Combined Potential Demand of 11-County Area Residents for Selected Recreation Activities 28

8 Percentage of California Population Spending Various Amounts of Time Traveling to Recreation Areas 29

9 Development of Percentage That Land in the 11 Counties Represents of Total Square Miles in Selected Time Zones . . 31

10 Percentage of Outdoor Recreation of 11-County Area Residents Concentrated in the 11-County Area 32

11 Total Annual Potential Demand of 11-County Area Residents for Selected Recreation Activities Probably Exercised in the Area 33

12 Annual Per Capita Potential Demand of Other California Residents for Selected Recreation Activities 36

13 Population of California, Excluding the 11-County Area . . . 37

14 Total Annual Potential Demand of Other California Residents for Selected Recreation Activities 38

15 Portion of Total Annual Potential Demand of Other California Residents for Selected Recreation Exercised in the 11-County Area 39

Preceding page blank

TABLES

16 Annual Potential Demand of Other U.S. Residents for Selected Recreation Activities 41

17 Trends in Annual Potential Demand of All Other U.S. Residents for Selected Recreation Activities 42

18 Total Passenger Miles of Domestic Intercity Travel and Total Number of Trips Taken by U.S. Residents, by Mode of Travel . 43

19 Estimated Number of Out-of-State Visitors to the 11-County Area 44

20 Participation in Outdoor Recreation and Outdoor Recreation Vacation Preferences of People Living in the West 45

21 Annual Per Capita Potential Demand of Other U.S. Residents for Selected Recreation Activities in the 11-County Area . 47

22 Portion of Total Annual Potential Demand of Other U.S. Residents for Selected Recreation Exercised in the 11-County Area 49

23 Portions of Total Annual Potential Demand of All Groups Exercised in the 11-County Area, by Activities 52

24 Recreation Sites with Sunbathing and Swimming Facilities . . 56

25 Sunbathing and Swimming--Development of 1960 Recreation Use Estimates 57

26 Sunbathing and Swimming--Projections of Expected Recreation Use 58

27 Natural Preserves and Parks in 11-County Area and Study Area 59

28 Sightseeing--Development of 1960 Recreation Use Estimates . . 60

29 Sightseeing--Projections of Expected Recreation Use 61

30 Recreation Motor Boating Facilities in the Study Area 62

31 Comparison of Participation Days in Boating and Fishing . . . 63

32 Expected Recreation Use in Motor Boating, Excluding Boat Fishing 64

33 Potential Demand and Expected Recreation Use, Motor Boating Excluding Boat Fishing 65

TABLES

34 Boat Access Area Parking Spaces 66

35 Motor Boating--Development of 1960 Recreation Use Estimates 66

36 Sailing--Development of 1960 Recreation Use Estimates . . . 67

37 Boating Excluding Boat Fishing--Projections of Expected Recreation Use 68

38 Distribution of Annual Water Skiing Activity 70

39 Water Skiing--Development of 1960 Recreation Use Estimates 71

40 Water Skiing--Projections of Expected Recreation Use . . . 72

41 Recreation Sites with Picnic Facilities 73

42 Picnicking--Development of 1960 Recreation Use Estimates . 74

43 Picnicking--Projections of Expected Recreation Use 75

44 Estimate of Acreages Used for Nature Walking, by Size of Areas 76

45 Nature Walking--Development of 1960 Recreation Use Estimates 76

46 Nature Walking--Projections of Expected Recreation Use . . 77

47 Recreation Sites with Camping Facilities 78

48 Camping--Development of 1960 Recreation Use Estimates . . . 79

49 Camping--Projections of Expected Recreation Use 80

50 Hiking--Development of 1960 Recreation Use Estimates . . . 81

51 Hiking--Projections of Expected Recreation Use. 82

52 Summary of Potential Demand, by Recreation Activity or of Recreation Use, Assuming No Limitation in Supply of Facilities 84

53 Summary of Expected Recreation Use by Activity, Assuming Continued Development of Facilities at Present Level of Demand Satisfaction 85

54 Estimates of Present Recreation Use by Activity 87

55 Estimates of Present Recreation Use by Activity and Region 88

TABLES

---

56 Estimates of Present Recreation Use by Activity and Type of Participant 89

57 Estimated Expected Sunbathing and Swimming Use, by Type of Participant and Region 92

58 Estimated Expected Sightseeing Use, by Type of Participant and Region 93

59 Estimated Expected Fishing Use, by Type of Participant and Region 94

60 Estimated Expected Boating Use, by Type of Participant and Region 95

61 Estimated Expected Water Skiing Use, by Type of Participant and Region 96

62 Estimated Expected Picnicking Use, by Type of Participant and Region 97

63 Estimated Expected Nature Walking Use, by Type of Participant and Region 98

64 Estimated Expected Waterfowl Hunting Use, by Type of Participant and Region 99

65 Estimated Expected Camping Use, by Type of Participant and Region 100

66 Estimated Expected Hiking Use, by Type of Participant and Region 101

67 Total Expected Recreation Use for All 10 Activities in the Study Area, by Type of Participant 102

68 Summary of Fishing and Hunting Use 108

69 Medium Unit Values 125

70 Summary of Annual Economic Benefits from Recreation . . . 134

71 Economic Benefits of Recreation Activities--San Francisco Bay and Delta Area (Medium Unit Values, Median Population Projections) 136

72 Economic Benefits of Recreation Activities--San Francisco Bay and Delta Area (High Unit Values, Median Population Projections) 137

TABLES

---

73 Economic Benefits of Recreation Activities--San Francisco Bay and Delta Area (High Unit Values, High Population Projections) 138

74 Economic Benefits of Recreation Activities--San Francisco Bay and Delta Area (Low Unit Values, Low Population Projections) 139

75 Economic Benefits of Recreation Activities--South San Francisco Bay (Medium Unit Values, Median Population Projections) 140

76 Economic Benefits of Recreation Activities--South San Francisco Bay (High Unit Values, Median Population Projections) 141

77 Economic Benefits of Recreation Activities--South San Francisco Bay (High Unit Values, High Population Projections) 142

78 Economic Benefits of Recreation Activities--South San Francisco Bay (Low Unit Values, Low Population Projections) 143

79 Economic Benefits of Recreation Activities--Central San Francisco Bay (Medium Unit Values, Median Population Projections) 144

80 Economic Benefits of Recreation Activities--Central San Francisco Bay (High Unit Values, Median Population Projections) 145

81 Economic Benefits of Recreation Activities--Central San Francisco Bay (High Unit Values, High Population Projections) 146

82 Economic Benefits of Recreation Activities--Central San Francisco Bay (Low Unit Values, Low Population Projections) 147

83 Economic Benefits of Recreation Activities--San Pablo Bay (Medium Unit Values, Median Population Projections) 148

84 Economic Benefits of Recreation Activities--San Pablo Bay (High Unit Values, Median Population Projections) 149

TABLES

85 Economic Benefits of Recreation Activities--San Pablo Bay (High Unit Values, High Population Projections) 150

86 Economic Benefits of Recreation Activities--San Pablo Bay (Low Unit Values, Low Population Projections) 151

87 Economic Benefits of Recreation Activities--Suisun Bay (Medium Unit Values, Median Population Projections) 152

88 Economic Benefits of Recreation Activities--Suisun Bay (High Unit Values, Median Population Projections) 153

89 Economic Benefits of Recreation Activities--Suisun Bay (High Unit Values, High Population Projections) 154

90 Economic Benefits of Recreation Activities--Suisun Bay (Low Unit Values, Low Population Projections) 155

91 Economic Benefits of Recreation Activities--Delta (Medium Unit Values, Median Population Projections) 156

92 Economic Benefits of Recreation Activities--Delta (High Unit Values, Median Population Projections) 157

93 Economic Benefits of Recreation Activities--Delta (High Unit Values, High Population Projections) 158

94 Economic Benefits of Recreation Activities--Delta (Low Unit Values, Low Population Projections). 159

95 Variations in Estimates of Total Annual Potential Demand and Recreational Use of All Persons Exercised in the Study Area for High and Low Population Projections 171

96 Variations in Estimates of Total Annual Potential Demand and Recreational Use for High and Low Population Projections 172

97 Probable Deviation of Per Capita Participation Day Estimates from Estimates Used in Report 173

98 Population Projections Used 177

I INTRODUCTION

Background

The cosmopolitan area surrounding San Francisco Bay is often described as one of the most beautiful in the world. It is that and more. With a mild, even climate and strategic location on a matchless natural harbor, it is a great commercial center--the "Gateway to the Orient" and the terminal of transcontinental railroads, highways, and airlines--a vast web of busy industrial cities making up a great population center, and the marketplace of a flourishing agriculture. In short, it is not only one of the most beautiful but also one of the most developed areas of the world.

The San Francisco Bay area surrounds 500 square miles of water in San Francisco Bay proper, San Pablo Bay, Suisun Bay, Grizzly Bay and the Carquinez Straits. Adjacent to the San Francisco Bay area is the Delta located at the confluence of the Sacramento and San Joaquin rivers. The Delta has an areal extent of approximately 740,000 acres bathed in 700 miles of interlacing waterways covering 50,000 acres. Almost 420,000 acres of land, known as the Delta Lowlands, lie between elevations of 5 feet above and 20 feet below sea level, protected from floods and high tides by man-made levees.

Because of its unique natural setting, the San Francisco Bay and Delta area provides excellent and varied water based recreational outlets.

Objectives

At the request of the Federal Water Pollution Control Administration, this study was undertaken to estimate:

1. Present and future recreation use of the waters and shores of the San Francisco Bay and Delta.
2. Present and future commercial fishery use in the area.
3. The economic benefits of recreation and commercial fishery in the area.

Definitions

The following definitions are used throughout the report.

1. Potential demand--the demand for a recreation activity that there would be if there were no limitations of facilities on participation. The term allows for the desires and abilities of people to participate and assumes the existence of necessary facilities.

2. Participation day--a measure of potential demand referring to days or parts of days that a participant would engage in a recreation activity if the necessary facilities were available. This is also used as a measure of actual or expected use of existing or planned facilities and refers to days or parts of days that a participant engages in a specific recreation activity.

3. Selected recreation activities--the forms of water based recreation included in the estimate. They are as follows, listed in the descending order of their use in the study area in 1965:

   a. Sunbathing and swimming
   b. Sightseeing
   c. Sport fishing
   d. Boating
   e. Water skiing
   f. Picnicking
   g. Nature walking
   h. Hunting
   i. Camping
   j. Hiking

4. Eleven-county area--the 11 California counties adjacent to the San Francisco Bay and Delta, including Alameda, Contra Costa, Marin, Napa, Sacramento, San Francisco, San Joaquin, San Mateo, Santa Clara, Solano, and Sonoma counties.

5. Study area--waters and shores of the San Francisco Bay, San Pablo Bay, Suisun Bay, Grizzly Bay, the Carquinez Straits, and the Delta channels of the Sacramento and San Joaquin Rivers.

6. Regions--five subdivisions of the study area (Figure 1):

   a. South San Francisco Bay--the part of the bay between the Oakland Bay Bridge and the land adjacent to the south bay

   b. Central San Francisco Bay--the part of the bay between the Oakland Bay Bridge and the Richmond-San Rafael Bridge

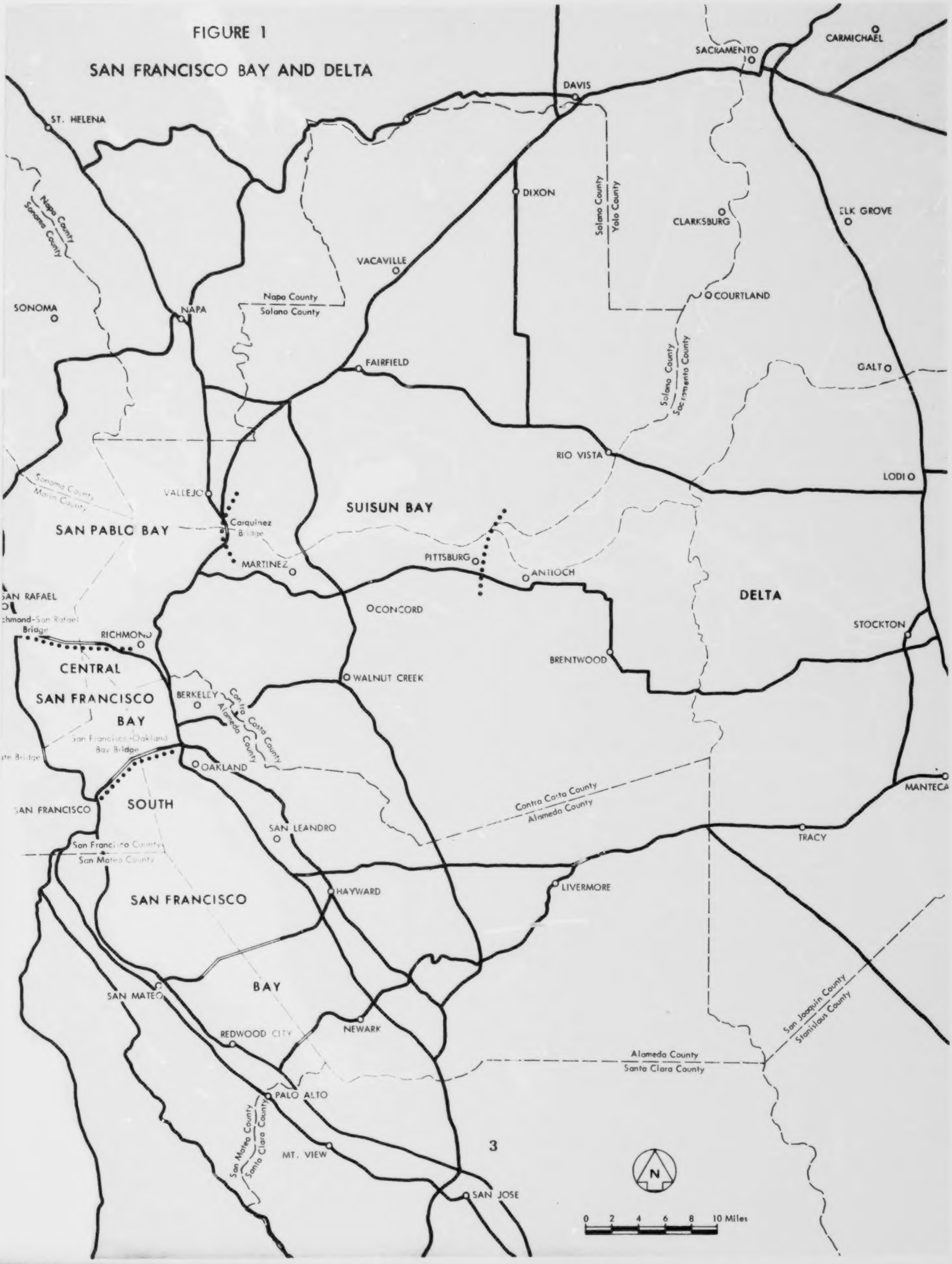
   c. San Pablo Bay--the part of the Bay between the Richmond-San Rafael Bridge and the Carquinez Bridge

   d. Suisun Bay--the area from Carquinez Bridge to a line between Pittsburg and Collinsville, including Carquinez Straits, Suisun Bay, and Grizzly Bay

   e. The Delta--the area upstream from Pittsburg to the limit of tidal influences, including the land and water channels formed by the San Joaquin and Sacramento Rivers.

FIGURE 1

SAN FRANCISCO BAY AND DELTA



ST. HELENA
DAVIS
SACRAMENTO
CARMICHAEL
DIXON
Napa County
Sonoma County
Solano County
Yolo County
CLARKSBURG
ELK GROVE
VACAVILLE
Napa County
Solano County
COURTLAND
SONOMA
NAPA
Solano County
Sacramento County
FAIRFIELD
GALT
RIO VISTA
LODI
Sonoma County
Marin County
VALLEJO
SUISUN BAY
Carquinez Bridge
SAN PABLO BAY
PITTSBURG
ANTIOCH
MARTINEZ
SAN RAFAEL
chmond-San Rafael Bridge
DELTA
CONCORD
RICHMOND
STOCKTON
CENTRAL SAN FRANCISCO BAY
BRENTWOOD
WALNUT CREEK
BERKELEY
Contra Costa County
Alameda County
San Francisco-Oakland Bay Bridge
ate Bridge
OAKLAND
MANTECA
SAN FRANCISCO
SOUTH
Contra Costa County
Alameda County
SAN LEANDRO
TRACY
San Francisco County
San Mateo County
HAYWARD
LIVERMORE
SAN FRANCISCO
BAY
SAN MATEO
San Joaquin County
Stanislaus County
NEWARK
REDWOOD CITY
Alameda County
Santa Clara County
PALO ALTO
San Mateo County
Santa Clara County
MT. VIEW
N
SAN JOSE
0
2
4
6
8
10 Miles

7. SMSA--standard metropolitan statistical area, as used in the 1960 Census. The following SMSAs, with the counties they include, were used in this study:

   a. San Francisco-Oakland (Alameda, Contra Costa, Marin, San Francisco, San Mateo, and Solano counties)

   b. San Jose (Santa Clara County)

   c. Sacramento (Sacramento County)

   d. Stockton (San Joaquin County)

Assumptions

Potential demands for different water based recreation activities were related primarily to family income, urbanization, and factors regarding travel, such as the time required to travel from home to recreation facilities and the length of vacations. Estimates of present use were based on available recreation facilities and their capabilities. Future projections were made on the assumption that the ratio of facility capacity to demand would be about the same throughout the projection period.

Although estimates are given for 1960, present use for both recreation and fishing is considered to be as of 1965. Projections of recreation and fishery use are made for each decade from 1960 through 2020. The projections include a three-way breakdown according to the residence of users.

1. Residents of the 11-county area
2. Residents of other California counties
3. Residents of other states

Population estimates for the 11-county area were provided by the Federal Water Pollution Control Administration. All other population estimates were made by SRI from several other sources of basic data.

Throughout the study, the quality of water in the San Francisco Bay and Delta area was assumed constant and at its present level.

The basic guide for establishing the dollar value of recreation benefits in the area was Supplement 1 to Senate Document 97, "Evaluation Standards for Primary Outdoor Recreation Benefits," June 4, 1964. Unit benefits from commercial fishing were calculated by multiplying the estimated annual catch in pounds by a unit value of 35 cents a pound.

II SUMMARY AND CONCLUSIONS

Total recreation use in the study area will increase from 13.1 million participation days a year in 1960 to about 75.7 million participation days a year in 2020. This increase, five and a half-fold, represents a rate larger than the rate of projected population growth of the area.

The larger increase in recreational use results from two factors: increased per capita participation rates in different recreational activities and increased amounts of travel that make the study area accessible to larger numbers of people **originating** outside of the 11-county area.

The principal water based recreation activities in the area are sunbathing and swimming, sightseeing, fishing, boating, and water skiing. These five activities account for 93 percent of the total number of participation days (Figure 2).

The most important species of fish, in terms of angler effort and recreation benefit, are striped bass and catfish. They account for about 75 percent of the total angler effort throughout the projection period.

Commercial fishing is a small industry devoted almost entirely to king salmon, which are taken in the coastal waters beyond the mouth of the Bay. This fishery is expected to decline throughout the projection period to about 60 percent of its present level due to increased sport fishing and expected water resource development. If an oyster or clam fishery could be re-established, the decline in commercial fishing might be somewhat offset. Such a fishery is impossible at present, however, primarily because of the bacteriological quality of the water and considerations of public health.

The five regions of the study area will have about the same proportions of total recreation use as they do now. South San Francisco Bay will continue to have the largest amount of use, about 37 percent of the total. This is followed by the Delta with 26 percent, Central San Francisco Bay with 22 percent, San Pablo Bay with 8 percent, Suisun Bay with 5 percent, and about 2 percent distributed between the ocean and the upper Sacramento River. These last two areas are included because the fish caught in these regions depend upon the Bay and Delta for migratory route and/or spawning grounds.

Most of the recreation use will be exerted by the residents of the 11-county area, although residents of other parts of California and the other states will exert an increasing proportion of the total recreation effort (Figure 3). This, again, is a result of increased travel by

FIGURE 2

BREAKDOWN OF RECREATION USE IN STUDY AREA
Millions of Participation Days
1965

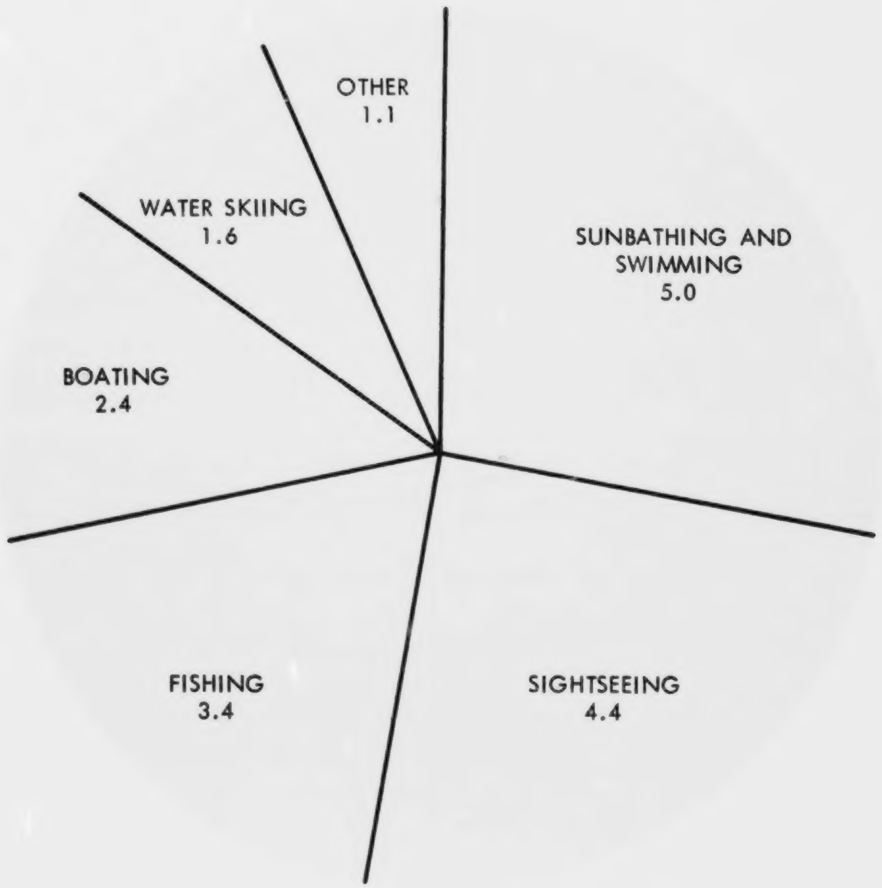


FIGURE 3

TOTAL RECREATION USE FOR ALL TEN ACTIVITIES IN STUDY AREA, BY TYPE OF PARTICIPANT

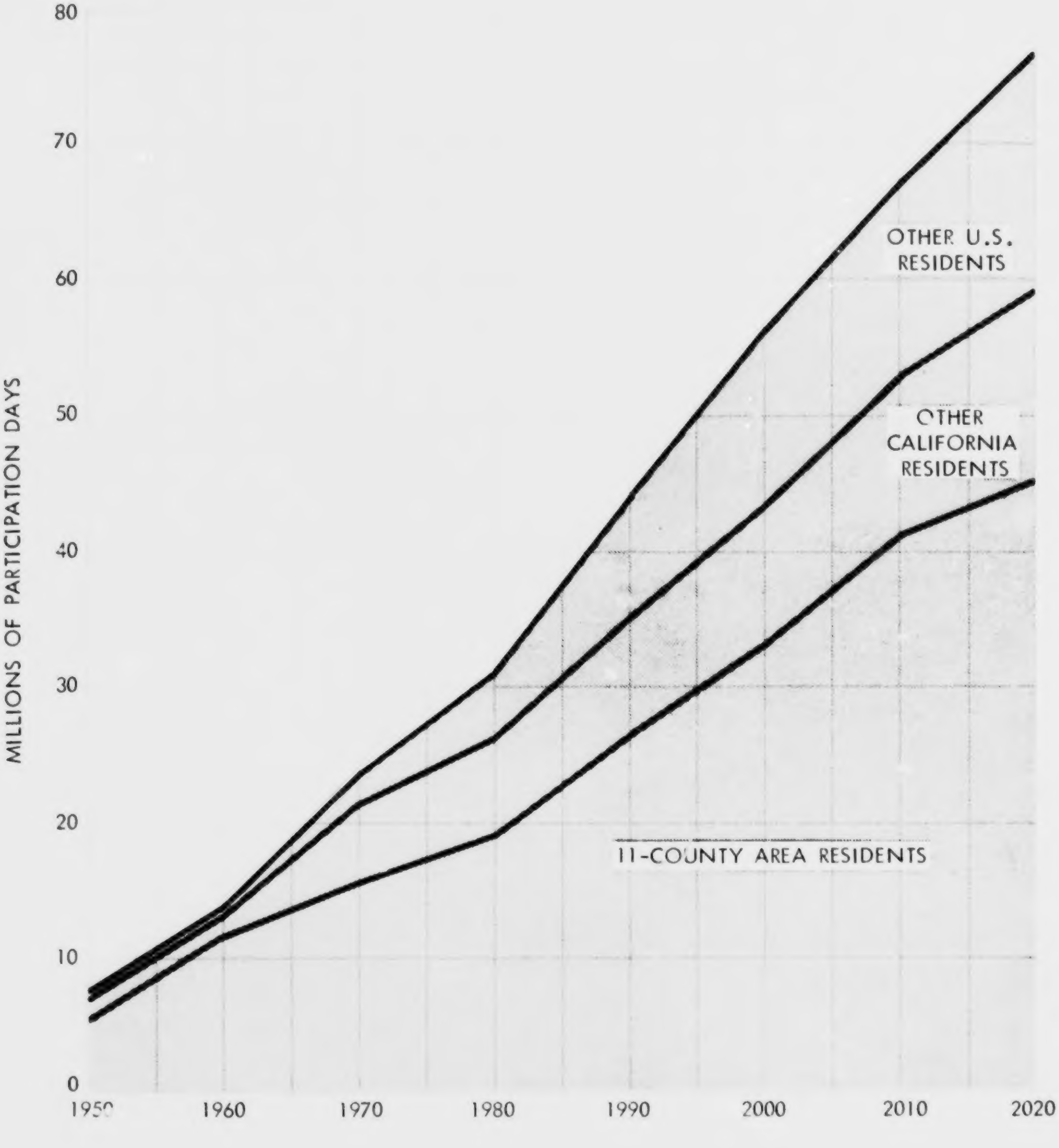
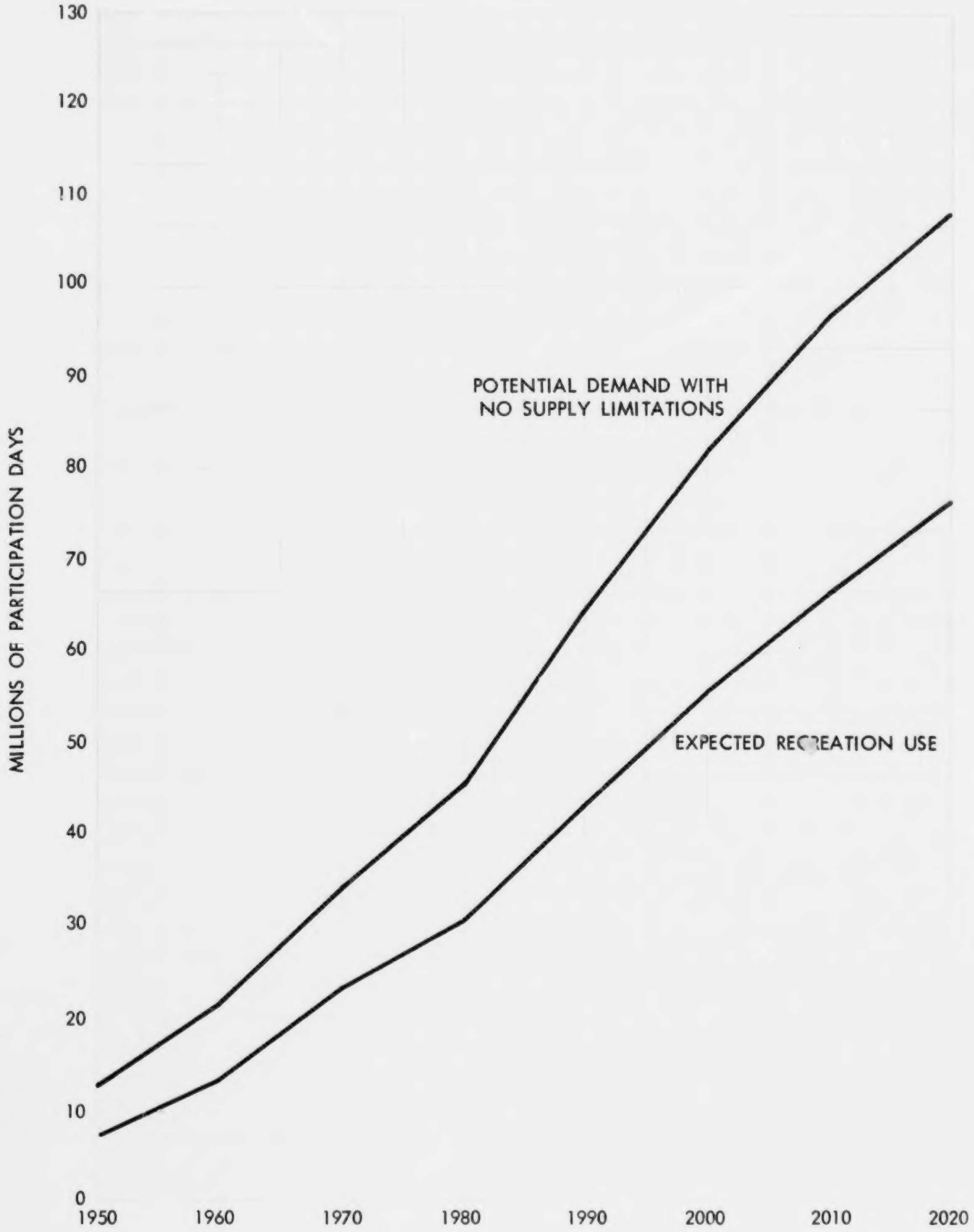


FIGURE 4

POTENTIAL DEMAND FOR RECREATION ACTIVITIES BASED ON ASSUMPTION OF NO LIMITATION IN SUPPLY OF FACILITIES, AND EXPECTED RECREATION USE



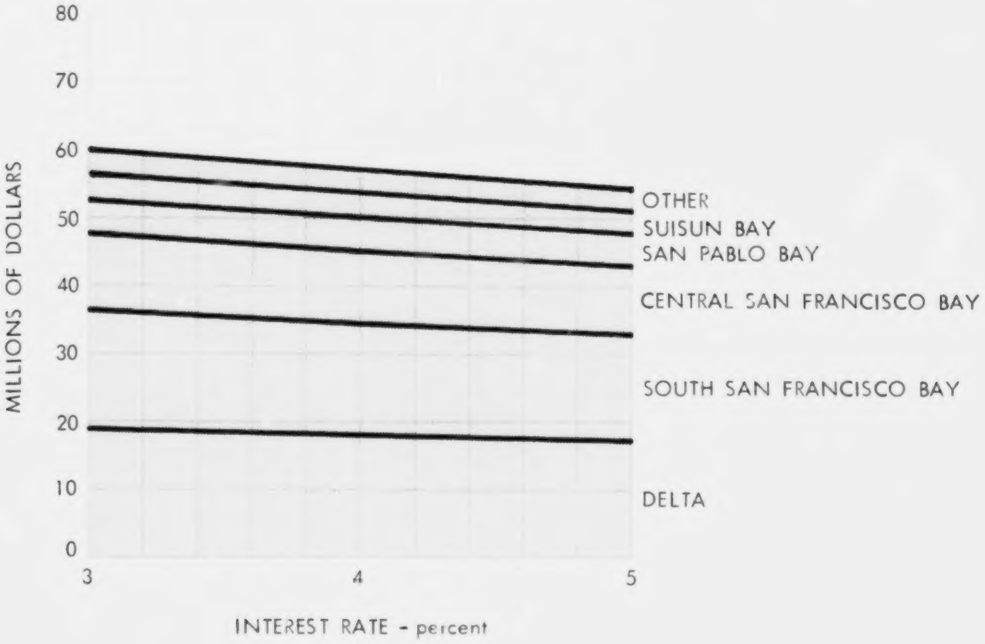
people into the 11-county area from other parts of California and the nation.

Use will probably be limited by a lack of facilities for all activities except sunbathing and swimming, sightseeing, and nature walking. By 2020, the difference between potential demand and use for all activities will be 32 million participation days a year (Figure 4).

In the case of fish and waterfowl, some of the limitations will be brought about by factors related to water resource development projects, as well as industrial and urban expansion. The species that will be affected are king salmon, steelhead, and waterfowl. With some exceptions, the decreased supply of fish and waterfowl will result in decreases in both angling and hunting.

FIGURE 5

ANNUAL ECONOMIC BENEFITS OF RECREATION ACTIVITIES
San Francisco Bay and Delta



The net economic benefits for recreational activities, including fishing and hunting, are based on unit recreation values, ranging from $0.50 to $1.50 per participation day for general activities and from $2 to $6 per participation day for special activities. General activities included in the lower range are sunbathing and swimming, sightseeing, boating, water skiing, picnicking, nature walking, camping, hiking, and fishing for catfish, largemouth black bass, and miscellaneous Bay area fish. Special activities included in the upper range are waterfowl hunting and fishing for striped bass, ocean and bay salmon, river salmon, unidentified Delta fish, American shad, steelhead, and sturgeon.

The annual benefits from all recreation activities are $59.6 million for the projection period 1970 to 2020 (Figure 5). The interest rate used in this computation was 3-1/8 percent, the rate currently prescribed for use in benefit computations by the federal government.

The annual benefits from commercial fishing are $1.38 million for the same projection period. These benefits are computed on the basis of a unit benefit of 35 cents a pound.

PART 1

ESTIMATES OF RECREATION USE OTHER THAN FISHING AND HUNTING

III APPROACH TO ESTIMATES OF RECREATION USE

The following steps were taken in estimating recreation use in the study area.

1. Determination of total potential demand by type of participant for each of the 10 selected recreation activities, assuming no limitations on the recreation facilities needed
2. Identification of the 11-county area's share of this total potential demand
3. Estimation of the study area's part of the share of total potential demand that could be exercised in the 11-county area
4. Estimation of the part of the study area's share of total potential demand that will probably be exercised, considering the recreation facilities available*
5. Allocation of recreation use in study area to subareas

Since the types of recreation sought, the intensity of recreation use, and trends in potential demand vary between residents of the 11-county area, residents of other California counties, and residents of other states, independent estimates were made for each type of participant and combined to obtain totals.

Likewise, since potential demand trends vary between recreation activities, separate estimates and projections were made for each of the 10 activities. To determine probable recreation use, these demand trends were then examined in light of the facilities needed for each activity.

To illustrate the approach to estimates of recreation use, data presented in Table 1 show the total demand for the 10 recreation activities in 1960. These figures merely represent summations of figures for the 10 activities. Although estimates for 1965 were subsequently made, 1960 is used in this example because detailed data were available for that year. It was also used as the base year for projections.

---

* This portion of potential demand is the recreation use in the study area.

Preceding page blank

Table 1

SUMMARY OF APPROACH TO ESTIMATES OF RECREATION USE*

	Type of Participant			Total
Research Step	11-County Area Residents	Other California Residents	Other U.S. Residents	All Participants
Total potential demand				
Per capita potential demand (in participation days)	37.20	35.85	28.55	29.22
Populations of areas represented (in millions)	4.39	11.33	163.61	179.33
Total potential demand of populations (in millions of participation days)	163.5	406.0	4,670.9	5,240.4
Eleven-county area share of total potential demand				
Percentage of total potential demand flowing to other areas	58.2%	94.5%	99.8%	98.1%
Other areas' share of total potential demand (in millions of participation days)	95.2	383.6	4,663.8	5,124.6
Eleven-county area share of total potential demand (in millions of participation days)	68.3	22.4	7.1	97.8
Study area portion of 11-county area share of total potential demand				
Percentage of 11-county area share not flowing to study area	77.4%	77.7%	78.5%	77.5%
Portion of 11-county area share not flowing to study area (in millions of participation days)	52.8	17.4	5.6	75.8
Portion of 11-county area share flowing to study area (in millions of participation days)	15.5	5.0	1.5	22.0

(continued)

Table 1 (concluded)

Research Step	Type of Participant			Total
	11-County Area Residents	Other California Residents	Other U.S. Residents	All Participants
Recreation use in study area				
Percentage of study area share not exercised because of facility limitations	41.3%	38.0%	20.0%	39.1%
Study area share of potential demand not exercised (in millions of participation days)	6.4	1.9	0.3	8.6
Potential demand exercised in study area (in millions of participation days)	9.1	3.1	1.2	13.4

---

* Figures represent totals for all 10 selected recreation activities, 1960.

Source: Stanford Research Institute.

Potential Demand for Selected Recreation Activities

Sections IV through VII develop estimates of total potential demand and the share of this demand that could be exercised in the 11 counties. Section IV considers the potential demand of residents of the 11-county area. For example, the combined per capita demand for all 10 recreation activities, estimated at 37.20 participation days in 1960 (Table 5), can be multiplied by the population of the area (4,391,700 in 1960) to produce an estimate of the total demand for the population--163.5 million participation days (Table 6).

It was found that 58.3 percent of this potential demand (Table 10) would be exercised outside the 11 counties. This percentage applied to the 163.5 million participation days of 11-county area residents gives 95.2 million participation days--the 1960 leakage in potential demand from the 11-county area. The difference of 68.3 million participation days (Table 11) represents the share of the 1960 total potential demand of 11-county area residents that was exercised within this area.

Section V develops similar estimates for residents of other California counties. Again using 1960 as an example, the combined per capita demand for all 10 recreation activities, estimated at 35.85 participation days (Table 12), multiplied by the population (11,325,500) (Table 13), produces an estimate of 406.0 million participation days (Table 14). A study of the impact of distance in relation to the origin of these other Californians and the recreation sites in the 11-county area resulted in the estimate that 94.5 percent of this demand would not be exercised in the 11-county area. The remaining 5.5 percent applied to the 406.0 million total participation day estimate produces a 22.4 million participation day estimate of the part of the total demand that was probably exercised in the 11-county area in 1960 (Table 15).

Section VI develops estimates for residents of other states. To provide data for comparison, per capita potential demand and total potential demand of this non-California population are presented. The combined per capita demand for the 10 recreation activities in 1960 was 28.55 participation days and the total was 4,670.9 million participation days (Table 16). The percentage of this total exercised in the 11-county area is extremely small, varying from 0.05 percent to 0.5 percent, depending on the activity. Therefore, the potential demand exercised in the area was developed by different techniques.

The number of out-of-state visitors to the 11-county area in 1960 was 1.71 million (Table 19). To this, an estimate of 4.17 participation days per capita for all activities (Table 21) was applied to obtain the total potential demand of 7.1 million participation days.

In Section VII the potential demands of these three types of participants are combined, as illustrated below, using the combined demand for the 10 activities.

Type of Participant	Potential Demand (in millions of participation days)	Source
11-county area residents	68.3	Table 11
Other California residents	22.4	Table 15
Other U.S. residents	7.1	Table 22
Total	97.8	Table 23

Estimates of Total Expected Use in the Study Area

In Section VIII, the potential demand estimates expected to be exercised in the 11-county area are allocated to the part of the 11-county area included in the study area. The study area's share is compared with existing and proposed facilities to identify actual recreation use being made and the use that can be expected. Demand and use are examined in this section by recreation activity instead of type of participant.

To determine the portion of the 11-county potential demand for an activity that would probably be exercised in the study area, existing and planned facilities needed for that activity in the study area were compared with the total for the 11-county area. Participation in some activities in the study area is very limited, and participation in some water oriented activities, such as sunbathing and swimming, frequently occurs at other points in the 11-county area. Therefore only a small percentage of the total participation exercised in the 11-county area will be exercised in the study area.

An activity-by-activity analysis revealed that 22 percent of the total participation in the 11-county area was concentrated in the study area. This resulted in a study area estimate of 22 million participation days of potential demand in 1960 (Table 52).

Potential demand, however, does not necessarily indicate recreation use. Because of facility limitations, use is normally less than potential demand.

The capability of facilities of different types to satisfy recreation demand was determined. Use per year per unit of facilities was applied to the number of existing and planned facilities in the study area to obtain recreation use. Facility deficiencies in 1960 limited total recreation use in the study area for the 10 activities to 13.1 million participation days (Table 53).

Estimates for 1965 are developed in Section IX by considering changes in population characteristics and size. As compared with a total use for the 10 activities in the study area of 13.1 million participation days in 1960, the 1965 estimate is placed at 17.9 million participation days (Table 54).

In Section X , projections of recreation use are broken down by activity, subarea, and type of participant.

IV POTENTIAL DEMAND OF 11-COUNTY AREA RESIDENTS

Potential demand of residents of the 11-county area was estimated for each of the 10 selected activities. This provided a base for estimating recreation use in the San Francisco study area.

Potential demand per capita estimates for the San Francisco-Oakland, San Jose, Sacramento, and Stockton SMSAs for 1950, 1960, 1970, and 1980 were available from previous SRI research.* Estimates made in this previous research were based on information in Outdoor Recreation Resources Review Commission Study Report No. 19, a report providing information on per capita recreation use for each of the 10 activities by various strata within seven classifications of socioeconomic characteristics: sex, age, urbanization, annual family income, education, race, and occupation.

These estimates were reviewed in light of recreation opportunities available to residents of the 11-county area and the probability of substituting activities for which favorable opportunities were available. Adjustments were made where needed to adapt these estimates to the recreation opportunities available to residents of the 11-county area.

Total participant days were then obtained by multiplying per capita estimates for each activity for 1950, 1960, 1970, and 1980 by the population of the appropriate area. The sum of the total participant days of the four SMSAs was then divided by the sum of the population of the SMSAs to obtain the per capita figures shown in Table 2.†

Similar per capita estimates were needed for 1990, 2000, 2010, and 2020. Because the previous SRI research had established that variation in family income, age, and degree of urbanization might influence change in per capita recreation demand significantly, relationships were established between potential per capita demand for each activity, as the dependent variable, and measures of family income, age, and degree of urbanization, as independent variables.

An initial effort was made to establish a multiple correlation relationship. Input data for 1960 for 18 geographic areas were used in a trial analysis, but the intercorrelation between independent variables provided a problem. Income, for example, increases--at least up to a point--with age. Therefore, although participation in an activity may

---

* Stanford Research Institute, Recreation and Parks Study, 1965.

† Since the four SMSAs did not include Napa or Sonoma counties, a small adjustment was needed. However, these two counties accounted for only 4.9 percent of the 1960 population of the 11-county area.

Table 2

ANNUAL PER CAPITA POTENTIAL DEMAND OF 11-COUNTY AREA RESIDENTS
FOR SELECTED RECREATION ACTIVITIES
1950-1980
(In Participation Days)

Activity	1950	1960	1970	1980
Sunbathing and swimming	7.14	10.84	13.39	13.84
Sightseeing	8.14	9.00	9.69	10.16
Fishing	2.87	2.99	2.99	2.78
Boating*	2.64	2.90	3.11	3.36
Water skiing	0.48	0.81	1.05	1.10
Picnicking	4.16	4.64	4.94	5.00
Nature walking	2.47	2.32	2.36	2.54
Hunting	0.91	0.59	0.54	0.53
Camping	1.22	1.96	2.15	2.03
Hiking	0.72	1.15	1.41	1.55

* Includes motor boating and sailing.

Source: Stanford Research Institute.

decline with age, the increase in participation accompanying increases in income of the same population group tends to offset the decline. There were similar problems between income and degree of urbanization although the interrelations were less pronounced.

To reduce this problem, a simple correlation technique was adopted, using only family income and degree of urbanization as separate independent variables. This allowed separate influences on participation in recreation to be examined.*

The results were two sets of regression equations with the same dependent variable, participation days per capita identified as X_1, but different independent variables. Family income, identified as X_2, was the independent variable used in one set, and the percentage of population classed as urban, identified as X_3, was the independent variable used in the other set. The resulting equations are summarized in the following tabulation.

---

* Inclusion of age as an independent variable does not improve the precision of the estimate.

Activity	X_2 = Family Income	X_3 = Percentage Urban
Sunbathing and swimming	$X_1 = -1.8521+0.0017X_2$	$X_1 = -1.2914+0.1313X_3$
Sightseeing	$X_1 = 2.2834+0.0009X_2$	$X_1 = 2.4782+0.0696X_3$
Fishing	$X_1 = 5.9805-0.0004X_2$	$X_1 = 6.7638-0.9415X_3$
Boating	$X_1 = 0.9178+0.0002X_2$	$X_1 = 0.7184+0.0168X_3$
Water skiing	$X_1 = -0.6847+0.0002X_2$	$X_1 = 0.5426+0.0029X_3$
Picnicking	$X_1 = 2.4013+0.0003X_2$	$X_1 = 7.2245-0.0291X_3$
Nature walking	$X_1 = 0.8266+0.0002X_2$	$X_1 = 2.7036-0.0028X_3$
Hunting	$X_1 = 4.3260-0.0005X_2$	$X_1 = 5.4077-0.0510X_3$
Camping	$X_1 = 0.4672+0.0002X_2$	$X_1 = 1.1826+0.0085X_3$
Hiking	$X_1 = -0.3444+0.0002X_2$	$X_1 = 0.2398+0.0142X_3$

Fishing and hunting are predominately activities of rural populations and lower income groups.

Forecasts of median family income and percentage of the population classed as urban were prepared. An analysis of other income projections together with projections of historical data for the 11-county area resulted in the following projections:

	Median Family Income[*]
1960	$ 7,467
1970	8,178
1980	8,575
1990	9,347
2000	10,058
2010	10,800
2020	11,542

Projections provided by the Federal Water Pollution Control Administration showed expected population changes for each county. A study of these expected population trends produced the following estimates of the percentage of the population classed as urban:[†]

---

[*] In 1960 dollars.

[†] The percentage of population in each county classified as urban in the 1960 U.S. Census was determined. It was assumed that the population growth expected after 1960 would be in urban portions of each county. Based on this assumption, the number and percentage classed as urban in future years was obtained.

	Percentage Classified as Urban
1960	92.4%
1970	96.3
1980	97.2
1990	98.6
2000	99.3
2010	99.6
2020	99.8

By applying the regression equations to these income and urbanization forecasts, the estimates of potential demand shown in Table 3 were prepared.

Other estimates were made by projecting the 1950 through 1980 trends in per capita participation days for each activity, using both linear and second-degree equations. In the linear projections, the value of the coefficient of change was positive for all activities except fishing and hunting, indicating a decline in per capita potential demand only for fishing and hunting. Computations resulting from these projections appear as Table 4.

The four estimates of per capita potential demand were then averaged and adjusted so that the 1980 estimate equaled the 1980 projection previously obtained (Table 2). The projection of the per capita estimates for sightseeing illustrate details of the methodology. The following estimates of potential demand in participation days per capita per year are obtained from the tables indicated.

Source or Comment	1950	1960	1970	1980	1990	2000	2010	2020
Table 2	8.14	9.00	9.69	10.16	--	--	--	--
Table 3	--	--	--	10.00	10.67	11.34	12.00	12.67
Table 3	--	--	--	9.24	9.34	9.39	9.41	9.42
Table 4	--	--	--	10.26	10.94	11.61	12.27	12.96
Table 4	--	--	--	10.16	10.45	10.54	10.43	10.13
Mean of data in Tables 3 and 4	--	--	--	9.92	10.35	10.72	11.03	11.30
Adjusted to 1980 Table 2 estimate	--	--	--	10.16	10.61	10.98	11.30	11.57

Table 3

ANNUAL PER CAPITA POTENTIAL DEMAND OF 11-COUNTY AREA RESIDENTS FOR SELECTED RECREATION ACTIVITIES BASED ON INCOME AND URBANIZATION FORECASTS

1980-2020

(In Participation Days)

	Based on Income Forecasts					Based on Urbanization Forecasts				
Activity	1980	1990	2000	2010	2020	1980	1990	2000	2010	2020
Sunbathing and swimming	12.73	13.99	15.25	16.51	17.77	11.47	11.65	11.75	11.79	11.81
Sightseeing	10.00	10.67	11.34	12.00	12.67	9.24	9.34	9.39	9.41	9.42
Fishing	2.55	2.25	1.96	1.66	1.36	2.73	2.67	2.64	2.63	2.62
Boating	3.17	3.36	. .54	3.73	3.92	3.01	3.04	3.06	3.06	3.06
Water skiing	1.03	1.18	1.33	1.48	1.62	0.82	0.83	0.83	0.83	0.83
Picnicking	4.97	5.20	5.42	5.64	5.86	4.40	4.36	4.33	4.33	4.32
Nature walking	2.54	2.69	2.84	2.99	3.14	2.43	2.43	2.43	2.42	2.42
Hunting	0.04	0.00	0.00	0.00	0.00	0.45	0.38	0.34	0.32	0.31
Camping	2.18	2.33	2.48	2.63	2.78	2.00	2.02	2.03	2.03	2.03
Hiking	1.37	1.52	1.67	1.82	1.96	1.14	1.16	1.17	1.17	1.18

Source: Stanford Research Institute.

Table 4

ANNUAL PER CAPITA POTENTIAL DEMAND OF 11-COUNTY AREA RESIDENTS FOR SELECTED RECREATION ACTIVITIES*

1980-2020

(In Participation Days)

Activity	Linear Projection					Second-Degree Projection				
	1980	1990	2000	2010	2020	1980	1990	2000	2010	2020
Sunbathing and swimming	14.70	16.97	19.23	21.50	23.76	13.89	12.90	10.29	6.06	0.20
Sightseeing	10.26	10.94	11.61	12.29	12.96	10.16	10.45	10.54	10.43	10.13
Fishing	2.87	2.84	2.81	2.79	2.76	2.79	2.42	1.92	1.22	0.37
Boating	3.36	3.60	3.84	4.07	4.31	3.37	3.60	3.82	4.04	4.25
Water skiing	1.18	1.39	1.60	1.81	2.02	1.10	1.04	0.83	0.48	†
Picnicking	5.11	5.39	5.67	5.95	6.24	5.00	4.87	4.52	3.96	3.19
Nature walking	2.49	2.51	2.54	2.56	2.59	2.54	2.90	3.42	4.10	4.95
Hunting‡	0.54	0.52	0.51	0.49	0.41	0.54	0.52	0.51	0.49	0.47
Camping	2.50	2.76	3.02	3.28	3.54	2.12	1.42	0.40	†	†
Hiking	1.62	1.90	2.17	2.45	2.72	1.56	1.53	1.37	1.07	0.62

---

* Based on projection of 1950-80 demand.

† Less than zero.

‡ Period 1960-80 was used instead of 1950-80 as the base for projection because of a major shift in per capita participation between 1950 and 1960.

Source: Stanford Research Institute.

However, the estimate for 1980 had previously been estimated as 10.16 instead of 9.92. Therefore, the 1980 mean of 9.92 was adjusted to equal 10.16 by multiplying it by 1.0242, an adjustment factor that was also applied to each of the other means as computed. The resulting estimates appear in Table 5.

Additional modifications were necessary in some cases. The adjusted per capita sunbathing and swimming estimate of participation days per year were computed as follows.

1950	1960	1970	1980	1990	2000	2010	2020
7.14	10.84	13.39	13.84	14.56	14.82	14.64	14.04

The decline in the average for sunbathing and swimming after 2000 was caused by a rapid decline in one of the four projections, with the other three holding at about 2000 level. It was assumed that the one declining projection was probably in error and that per capita participation would not change after 2000. Therefore, the 14.82 estimate was used for 2010 and 2020 as well as for 2000.

Estimates shown in Table 5 were then applied to the median population projections provided by the Federal Water Pollution Control Administration to obtain the estimates of total potential demand for the population of the study area shown in Table 6. (See Appendix B for population projections.)

Estimates of per capita demand for the far-future years are subject to varying degrees of accuracy. Significant variations from the estimates are possible for the years after 2000. This, for example, could mean that total per capita demand for all 10 recreation activities in 2020 could vary from as low as 30 to as high as 70 participation days a year. If these per capita rates are applied to the various population projections, the conclusion is reached that the total demand of residents of the 11-county area will be three to six times the 1960 level by 2020 (Table 7). These possible variations from the figure presented in Table 6 are discussed in Appendix A.

The availability of free time not only limits participation in recreation but limits the distance potential participants will travel. Since short intervals of free time are more frequent than long intervals, short travel distances to recreation facilities are more common than long distances. Therefore, many area residents can be expected to seek recreation opportunities within the area.

Some people, however, will travel considerable distances to participate in outdoor recreation. An analysis of data developed by the California Division of Beaches and Parks establishes the function of distance

Table 5

FINAL ESTIMATES OF ANNUAL PER CAPITA POTENTIAL DEMAND OF 11-COUNTY AREA RESIDENTS FOR SELECTED RECREATION ACTIVITIES

1950-2020

(In Participation Days)

Activity	1950	1960	1970	1980	1990	2000	2010	2020
Sunbathing and swimming	7.14	10.84	13.39	13.84	14.56	14.82	14.82	14.82
Sightseeing	8.14	9.00	9.69	10.16	10.61	10.98	11.30	11.57
Fishing	2.87	2.99	2.99	2.78	2.58	2.37	2.11	1.81
Boating	2.64	2.90	3.11	3.36	3.54	3.71	3.88	4.05
Water skiing	0.48	0.81	1.05	1.10	1.18	1.22	1.23	1.23
Picnicking	4.16	4.64	4.94	5.00	5.09	5.12	5.12	5.12
Nature walking	2.47	2.32	2.36	2.54	2.67	2.85	3.07	3.33
Hunting	0.91	0.59	0.54	0.53	0.48	0.46	0.44	0.42
Camping	1.22	1.96	2.15	2.03	1.97	1.83	1.83	1.83
Hiking	0.72	1.15	1.41	1.55	1.66	1.74	1.77	1.77
Total	30.75	37.20	41.63	42.89	44.34	45.10	45.57	45.95

Source: Stanford Research Institute.

Table 6

TOTAL ANNUAL POTENTIAL DEMAND OF 11-COUNTY AREA RESIDENTS FOR SELECTED RECREATION ACTIVITIES BASED ON MEDIAN POPULATION PROJECTIONS

1950-2020

(In Millions of Participation Days)

Activity	1950	1960	1970	1980	1990	2000	2010	2020
Sunbathing and swimming	22.6	47.6	80.3	99.2	142.1	179.7	216.4	238.9
Sightseeing	25.7	39.5	58.1	72.8	103.5	133.1	165.0	186.5
Fishing	9.1	13.1	17.9	19.9	25.2	28.7	30.8	29.2
Boating	8.3	12.8	18.6	23.9	34.5	45.0	56.7	65.3
Water skiing	1.5	3.6	6.3	7.9	11.5	14.4	18.0	19.8
Picnicking	13.1	20.4	29.6	35.8	49.7	62.1	74.8	82.5
Nature walking	7.8	10.2	14.2	18.2	26.1	34.6	44.8	53.7
Hunting	2.9	2.6	3.2	3.8	4.7	5.6	6.4	6.8
Camping	3.9	8.6	12.9	14.5	19.2	22.2	26.7	29.5
Hiking	2.3	5.1	8.5	11.1	16.2	21.1	25.8	28.5
Total	97.2	163.5	249.6	307.1	432.7	546.5	665.4	740.7

Source: Stanford Research Institute.

Table 7

PROJECTIONS OF COMBINED POTENTIAL DEMAND OF 11-COUNTY AREA RESIDENTS FOR SELECTED RECREATION ACTIVITIES

1950-2020

(In Millions of Participation Days)

	Population Projection Level								
	Low per Capita Participation Rate			Median per Capita Participation Rate			High per Capita Participation Rate		
Year	Low	Median	High	Low	Median	High	Low	Median	High
1950	97.2	97.2	97.2	97.2	97.2	97.2	97.2	97.2	97.2
1960	163.5	163.5	163.5	163.5	163.5	163.5	163.5	163.5	163.5
1970	226.5	242.4	247.6	238.7	249.6	255.1	245.9	257.2	262.8
1980	270.8	291.7	302.9	285.4	307.1	319.3	300.8	324.0	336.6
1990	340.6	393.2	447.8	374.8	432.7	489.5	412.5	476.2	538.7
2000	373.4	480.6	610.0	428.9	546.5	694.1	483.8	622.7	790.3
2010	391.0	566.1	799.6	459.7	665.4	940.0	539.9	781.6	1,104.1
2020	365.3	619.5	999.2	436.6	740.7	1,194.5	521.6	884.8	1,427.1

Source: Stanford Research Institute.

in reducing visits to recreation areas at varying distances from the homes of participants.* In Table 8, travel distance has been converted to time, showing the percentage of California population that would spend various amounts of time traveling to a recreation area.

Table 8

PERCENTAGE OF CALIFORNIA POPULATION SPENDING VARIOUS AMOUNTS OF TIME TRAVELING TO RECREATION AREAS
1960

Destination or Travel Time	Percentage of Total Visiting Recreation Areas
To recreation areas in California	
0 to 1 hour	40.7%
1 to 2 hours	14.2
2 to 3 hours	8.1
3 to 4 hours	5.5
4 to 5 hours	4.2
5 to 6 hours	3.4
More than 6 hours	4.1
Subtotal	80.2%
To out-of-state recreation areas	19.8
Total	100.0%

Source: Stanford Research Institute.

To adapt Table 8 data to the 11-county area, the number of existing and potential recreation areas in each time zone was identified. To do this, one, two, and three-hour travel time zones were established about the population center of each county, and the number of recreation areas in each time zone was identified. It was established that the geographic spread of probable potential recreation areas in these time zones would correspond to the geographic spread of the land area within the time zones.

---

* California Division of Beaches and Parks, Program for California's Beaches and Parks, 1961.

With this background, Table 9 was developed to estimate the percentage of the potential recreation areas in the time zones.

If all the 0-to-1 hour zone of Alameda County residents is in the 11-county area (Table 9), 40.7 percent of the outdoor recreation (Table 8) will be sought by residents in the 11-county area. If, as in the case of Sacramento County, only 45.4 percent of the total land area in the 0-to-1 hour zone is within the 11-county area, then only 18.5 percent (40.7 x 45.4 = 18.5) of the outdoor recreation of Sacramento County residents will occur in this 11-county area.

Similar estimates are made for the 1-to-2 hour zone. (Since very little of the 11-county area is beyond the 2-hour zone, that portion of the area was ignored.) The results of these calculations (Table 10) show that approximately 41.7 percent of the potential outdoor recreation demand of the residents of the 11-county area will be exercised within the 11-county area.

Application of this 41.7 percent to the data previously developed (Table 6) provides estimates of the potential outdoor recreation demand of 11-county area residents expected to be exercised within the 11 counties. This is shown in Table 11.

Table 9

DEVELOPMENT OF PERCENTAGE THAT LAND IN THE 11 COUNTIES REPRESENTS OF TOTAL SQUARE MILES IN SELECTED TIME ZONES

	Square Miles in Time Zone (A)		Square Miles in 11-County Area (B)		Percentage Portion of Total Land in 11-County Area* (B ÷ A) (C)	
County	0–1 Hour Zone †	1–2 Hour Zone †	0–1 Hour Zone †	1–2 Hour Zone †	0–1 Hour Zone †	1–2 Hour Zone †
Alameda	4,163	10,851	4,163	5,181	100.0%	47.7%
Contra Costa	4,636	10,563	4,621	4,723	99.7	44.7
Marin	3,656	10,738	3,651	5,693	99.9	53.0
Napa	5,521	13,363	4,491	4,853	81.3	36.3
Sacramento	6,358	22,362	2,888	6,456	45.4	28.9
San Francisco	3,878	9,796	3,878	5,466	100.0	55.8
San Joaquin	6,358	20,661	4,173	5,171	65.6	25.0
San Mateo	3,431	10,518	3,431	5,913	100.0	56.2
Santa Clara	5,134	13,730	4,199	5,145	81.8	37.5
Solano	5,818	12,636	5,303	4,041	91.1	32.0
Sonoma	4,635	13,039	3,535	5,809	76.3	44.6

---

* To be used as estimate of percentage of potential recreation areas in each time zone within the 11-county area.

† From the center of population of county; excludes water areas.

Source: Stanford Research Institute.

Table 10

PERCENTAGE OF OUTDOOR RECREATION OF 11-COUNTY AREA RESIDENTS CONCENTRATED IN THE 11-COUNTY AREA

County	In Area: In 0-1 Hour Zone	In Area: In 1-2 Hour Zone	In Area: Total	Outside Area
Alameda	40.7%	6.8%	47.5%	52.5%
Contra Costa	40.6	6.3	46.9	53.1
Marin	40.7	7.5	48.2	51.8
Napa	33.1	5.2	38.3	61.7
Sacramento	18.5	4.1	22.6	77.4
San Francisco	40.7	7.9	48.6	51.4
San Joaquin	26.7	3.6	30.3	69.7
San Mateo	40.7	8.0	48.7	51.3
Santa Clara	33.3	5.3	38.6	61.4
Solano	37.1	4.5	41.6	58.4
Sonoma	31.0	6.3	37.3	62.7
Mean*	35.7	6.0	41.7	58.3

---

* Weighted by 1960 populations.

Source: Stanford Research Institute.

Table 11

TOTAL ANNUAL POTENTIAL DEMAND OF 11-COUNTY AREA RESIDENTS FOR SELECTED RECREATION ACTIVITIES PROBABLY EXERCISED IN THE AREA*

1950-2020

(In Millions of Participation Days)

Activity	1950	1960	1970	1980	1990	2000	2010	2020
Sunbathing and swimming	9.4	19.8	33.5	41.4	59.3	74.9	90.2	99.6
Sightseeing	10.7	16.5	24.2	30.4	43.2	55.5	68.8	77.8
Fishing	3.8	5.5	7.5	8.3	10.5	12.0	12.8	12.2
Boating	3.1	5.4	7.8	10.0	14.4	18.8	23.7	27.2
Water skiing	0.6	1.5	2.6	3.3	4.8	6.2	7.5	8.3
Picnicking	5.5	8.5	12.3	14.9	20.7	25.9	31.2	34.4
Nature walking	3.3	4.3	5.9	7.6	10.9	14.4	18.7	22.4
Hunting	1.2	1.1	1.3	1.6	2.0	2.3	2.7	2.8
Camping	1.6	3.6	5.4	6.0	8.0	9.3	11.1	12.3
Hiking	1.0	2.1	3.5	4.6	6.8	8.8	10.8	11.9
Total	40.2	68.3	104.0	128.1	180.6	228.1	277.5	308.9

---

* Based on median population projections and median per capita participation ratio.

Source: Stanford Research Institute.

V POTENTIAL DEMAND OF ALL OTHER CALIFORNIA RESIDENTS

Per capita potential demand was estimated for California residents living outside the 11-county area by using a technique similar to that described for estimating the demand of area residents. The results appear as Table 12.

Projections of this other California population are shown in Table 13. Estimates for 2000 and 2010 were prepared using the 1950-to-1990 trend as a base and adjusting these projections to the 2020 estimate of the Department of Water Resources.

Applying per capita demand estimates to population projections for the respective years provided the total potential demand estimates of Table 14.

Part of this demand will not be exercised in the 11 counties. The decay curve from which the data in Table 8 were developed can also be applied to other California residents. Study of the location of other California populations in relation to the 11-county area indicates that approximately 94.5 percent of the total demand (shown in Table 14) is not exercised in the 11-county area. This remaining portion of the potential demand of these other California residents (shown in Table 15) represents the share of the total potential demand of other California residents that is expected to be exercised within the 11-county area.

Preceding page blank

Table 12

ANNUAL PER CAPITA POTENTIAL DEMAND OF OTHER CALIFORNIA RESIDENTS FOR SELECTED RECREATION ACTIVITIES

1950-2020

(In Participation Days)

Activity	1950	1960	1970	1980	1990	2000	2010	2020
Sunbathing and swimming	6.46	9.81	12.21	12.70	13.36	13.60	13.60	13.60
Sightseeing	7.66	8.47	9.21	9.80	10.23	10.59	10.90	11.16
Fishing	3.17	3.30	3.23	3.03	2.81	2.58	2.30	2.02
Boating	2.48	2.73	2.98	3.24	3.41	3.58	3.74	3.91
Water skiing	0.46	0.77	0.99	1.04	1.12	1.15	1.16	1.16
Picnicking	4.01	4.47	4.81	4.89	4.98	5.01	5.01	5.01
Nature walking	2.32	2.18	2.13	2.27	2.47	2.55	2.74	2.98
Hunting	1.72	1.12	0.84	0.77	0.70	0.67	0.64	0.61
Camping	1.24	1.99	2.23	2.15	2.09	1.94	1.94	1.94
Hiking	0.63	1.01	1.31	1.43	1.53	1.61	1.63	1.63
Total	30.15	35.85	39.94	41.32	42.70	43.28	43.66	44.02

Source: Stanford Research Institute.

Table 13

POPULATION OF CALIFORNIA, EXCLUDING THE 11-COUNTY AREA
1950-2020

Year	Population (thousands)	Source
1950	7,426.4	U.S. Bureau of the Census
1960	11,325.5	U.S. Bureau of the Census
1970	15,924.3	California Department of Finance
1980	20,509.5	California Department of Finance
1990	25,248.6	California Department of Water Resources
2000	28,989.0	Stanford Research Institute
2010	33,301.8	Stanford Research Institute
2020	38,762.2	California Department of Water Resources

Source: Stanford Research Institute

Table 14

TOTAL ANNUAL POTENTIAL DEMAND OF OTHER CALIFORNIA RESIDENTS FOR SELECTED RECREATION ACTIVITIES
1950-2020
(In Millions of Participation Days)

Activity	1950	1960	1970	1980	1990	2000	2010	2020
Sunbathing and swimming	48.0	111.1	194.4	260.5	337.3	394.3	452.9	527.2
Sightseeing	56.9	95.9	146.7	201.0	258.3	307.0	363.0	432.6
Fishing	23.5	37.4	51.4	62.1	70.9	74.8	76.6	78.3
Boating	18.4	31.0	47.5	66.4	86.1	103.8	130.5	156.6
Water skiing	3.4	8.7	15.8	21.3	28.3	33.3	38.6	45.0
Picnicking	29.8	50.6	76.6	100.3	125.7	145.2	166.8	194.2
Nature walking	17.2	24.7	33.9	46.6	62.4	73.9	91.2	115.5
Hunting	12.8	12.7	13.4	15.8	17.7	19.4	21.3	23.6
Camping	9.2	22.5	35.5	44.1	52.8	56.2	64.6	75.2
Hiking	4.7	11.4	20.9	29.3	38.6	46.7	54.3	63.2
Total	223.9	406.0	636.1	847.4	1,078.1	1,254.6	1,453.8	1,706.4

Source: Stanford Research Institute.

Table 15

PORTION OF TOTAL ANNUAL POTENTIAL DEMAND OF OTHER CALIFORNIA RESIDENTS
FOR SELECTED RECREATION EXERCISED IN THE 11-COUNTY AREA
1950-2020
(In Millions of Participation Days)

Activity	1950	1960	1970	1980	1990	2000	2010	2020
Sunbathing and swimming	2.6	6.1	10.7	14.3	18.6	21.7	24.9	29.0
Sightseeing	3.1	5.3	8.1	11.1	14.2	16.9	20.0	23.8
Fishing	1.3	2.1	2.8	3.4	3.9	4.1	4.2	4.3
Boating	1.0	1.7	2.6	3.7	4.7	5.7	6.8	8.3
Water skiing	0.2	0.5	0.9	1.2	1.6	1.8	2.1	2.5
Picnicking	1.6	2.8	4.2	5.5	6.9	8.0	9.2	10.7
Nature walking	0.9	1.4	1.9	2.6	3.4	4.1	5.0	6.4
Hunting	0.7	0.7	0.7	0.9	1.0	1.1	1.2	1.3
Camping	0.5	1.2	2.0	2.4	2.9	3.1	3.6	4.1
Hiking	0.3	0.6	1.1	1.6	2.1	2.6	3.0	3.5
Total	12.2	22.4	35.0	46.7	59.3	69.1	80.0	93.9

Source: Stanford Research Institute.

VI POTENTIAL DEMAND OF ALL OTHER U.S. RESIDENTS

Some residents of other states will seek recreation opportunities in the 11-county area. Estimates in Table 16 were prepared by using methods similar to those already described.

Since the portions of the total potential demand of these non-California residents that is expected to be exercised in the 11-county area are small--varying from about 0.05 percent to 0.5 percent of the total demand for individual activities of these people--no effort was made to estimate trends in this total demand by activity. Instead, potential demand in relation to the number of out-of-state visitors and average length of stay was estimated. For purposes of comparison with

Table 16

ANNUAL POTENTIAL DEMAND OF OTHER U.S. RESIDENTS*
FOR SELECTED RECREATION ACTIVITIES
1960

Activity	Per Capita Demand (in participation days)	Total Potential Demand (in millions of participation days)
Sunbathing and swimming	6.47	1,058.5
Sightseeing	5.91	966.9
Fishing	4.19	685.5
Boating	2.18	356.7
Water skiing	0.41	67.1
Picnicking	3.53	577.5
Nature walking	2.70	441.7
Hunting	1.86	304.3
Camping	0.88	144.0
Hiking	0.42	68.7
Total	28.55	4,670.9

---

* Excludes California residents.

Source: Stanford Research Institute based on data from Outdoor Recreation Resources Review Commission.

Preceding page blank

previous estimates, however, trends in the combined potential demand for the 10 recreation activities by non-Californians are presented in Table 17. (See Appendix B for the population projections used.)

Table 17

TRENDS IN ANNUAL POTENTIAL DEMAND OF ALL OTHER U.S. RESIDENTS* FOR SELECTED RECREATION ACTIVITIES 1950-2020

Year	Per Capita Demand in Participation Days	Total Potential Demand in Millions of Participation Days
1950	23.60	3,318.2
1960	28.55	4,670.9
1970	32.98	6,239.2
1980	34.24	7,560.9
1990	35.69	8,743.7
2000	36.45	9,800.7
2010	36.92	10,784.3
2020	37.30	11,754.0

---

* Excludes California residents.

Source: Stanford Research Institute.

The following estimate of number of visitors to the San Francisco Bay area was provided by the San Francisco Convention and Visitors Bureau:

1952	1,126,071	1956	1,549,046	1961	1,761,508
1953	1,179,360	1957	1,538,850	1962	1,937,397
1954	1,400,367	1958	1,468,417	1963	2,086,000
1955	1,496,835	1959	1,622,923	1964	2,347,916
		1960	1,711,963	1965	2,683,916

Intercity travel has been estimated by the Automobile Manufacturers Association in terms of passenger miles by mode of travel with projections to 2000 (Table 18). In addition, the number of 100-mile or overnight trips taken by U.S. residents was estimated by the Bureau of the Census for 1957 and 1963, and for other years by SRI. From these statistics,

Table 18

TOTAL PASSENGER MILES OF DOMESTIC INTERCITY TRAVEL AND TOTAL NUMBER OF TRIPS TAKEN BY U.S. RESIDENTS BY MODE OF TRAVEL

1950-2000

Year	Automobile	Motor Coach	Airways	Railroads	Other	Total
Passenger Miles (Billions)						
1950	402.8	26.4	10.1	32.5	1.4	473.2
1955	585.8	25.5	22.7	28.7	1.7	664.4
1960	706.1	19.9	34.0	21.6	2.6	784.3
1965	840.0	23.0	56.0	18.0	2.8	939.8
1970	999.8	19.1	66.6	14.1	2.3	1,101.9
1980	1,434.3	19.4	107.8	13.5	2.7	1,577.7
1990	2,009.0	19.2	160.7	14.1	3.2	2,233.1
2000	2,890.5	18.2	225.0	18.2	3.6	3,155.5
Number of Trips (Millions)						
1950	68.7	2.9	1.9	3.1	7.4	84.0
1955	158.5	5.2	5.6	7.2	8.1	184.6
1960	302.7	7.7	11.2	8.7	11.6	341.9
1965	573.6	17.6	25.1	11.6	11.6	639.5
1970	880.3	18.8	38.6	11.7	12.3	961.7
1980	1,593.6	23.8	78.6	14.2	18.5	1,728.7
1990	2,524.7	27.1	132.5	16.7	24.5	2,725.5
2000	3,746.9	26.4	191.3	22.2	28.3	4,015.1

Sources: Automobile Manufacturers Association, U.S. Bureau of the Census, and Stanford Research Institute.

forecasts of the number of trips expected to be taken in 1970, 1980, 1990, and 2000 were made.

An analysis of these data in relation to the number of visitors to the area indicates that about 0.5 percent of all trips by U.S. residents are made to the area and that this percentage will probably continue. This produces an estimate of some 16 million visitors to the area in 2000. A linear projection of the 1950 to 2000 figures was used to obtain the estimates for 2010 and 2020 shown in Table 19.

Table 19

ESTIMATED NUMBER OF OUT-OF-STATE VISITORS TO THE 11-COUNTY AREA
1950-2020

Year	Visitors (millions)
1950	0.8
1960	1.7
1970	3.9
1980	6.9
1990	10.9
2000	16.1
2010	18.6
2020	22.2

Source: Stanford Research Institute.

To obtain per capita demand estimates, information was obtained on annual per capita participation in selected outdoor recreation activities and vacation preference of people living in the west, the major out-of-state market for vacation travel to the 11-county area. These data are shown in Table 20.

The types of recreation activities of non-Californians concerned here involve travel. This travel may be classified as outdoor recreation outings, not including overnight stays; outdoor recreation trips, including short overnight trips and weekend trips; and vacations. The number of outdoor recreation occasions of each type engaged in by the average person living in the west in 1960 is shown in the following tabulation:

Table 20

PARTICIPATION IN OUTDOOR RECREATION AND OUTDOOR RECREATION VACATION PREFERENCES OF PEOPLE LIVING IN THE WEST 1960

	Recreation Demand (in participation days)		Percentage Preferring Activity While on Vacation	
Activity	Per Capita*	Total* (millions)	People 25 Years Old and Over	Employed People 14 Years Old and Over
Sunbathing and swimming	7.63	85.05	12%	14%
Sightseeing	7.46	83.16	23	22
Fishing	3.93	43.81	14	14
Boating	2.03	22.63	3	2
Water skiing	0.62	6.91	†	†
Picnicking	4.30	47.93	2	2
Nature walking	2.88	32.10	†	†
Hunting	1.36	15.16	1	2
Camping	2.00	22.29	6	8
Hiking	0.72	8.03	†	†

---

* Based on 1960 population of mountain and mainland Pacific Coast states, excluding California. These data differ from those in Table 16 because they apply to the west and those in Table 16 apply to the nation.

† Less than 0.5 percent.

Sources: Outdoor Recreation Resources Review Commission and Stanford Research Institute.

Type of Recreation Occasions	Number of Outdoor Recreation Occasions per Capita, 1960
Vacations	0.74
Trips	1.07
Outings	8.10
Total	9.91

Source: Outdoor Recreation Resources Review Commission.

Vacations averaged 7.6 days for people living in the west, as compared with 2.7 days for trips and less than one day for outings. Based on these figures, adjusted for driving time and non-outdoor vacation demands, the potential demand of the average vacationer was estimated at between 10 and 12 participation days. Thus, the average person participated in more than one outdoor recreation activity per day while on vacation (between 1.3 and 1.6).

The average out-of-state visitor stays three or four days in the 11-county area. In such urban areas as this, visitors participate less frequently in outdoor recreation than in nonurban areas. Also, part of the outdoor recreation in which a visitor participates is in activities not considered in this study, such as attending outdoor sporting events. Nevertheless, it is estimated that the average out-of-state visitor to the area participates in the types of outdoor recreation considered here about four times during his three or four day stay. The following tabulation breaks down potential demand in terms of participation days per capita for out-of-state visitors to the area.

Activity	Participation Days per Capita
Sunbathing and swimming	0.82
Sightseeing	1.57
Fishing	0.86
Boating	0.20
Picnicking	0.12
Hunting	0.06
Camping	0.39

These 1960 per capita estimates were adjusted to other years by applying the trends developed for California residents. The resulting estimates for out-of-state visitors are shown in Table 21.

Table 21

ANNUAL PER CAPITA POTENTIAL DEMAND OF OTHER U.S. RESIDENTS* FOR SELECTED RECREATION ACTIVITIES IN THE 11-COUNTY AREA
1950-2020
(In Participation Days)

Activity	1950	1960	1970	1980	1990	2000	2010	2020
Sunbathing and swimming	0.54	0.82	1.02	1.06	1.12	1.14	1.14	1.14
Sightseeing	1.42	1.57	1.71	1.82	1.90	1.96	2.02	2.07
Fishing	0.82	0.86	0.84	0.79	0.73	0.67	0.60	0.53
Boating	0.18	0.20	0.23	0.24	0.25	0.27	0.28	0.29
Water skiing	0.04	0.06	0.08	0.09	0.09	0.10	0.10	0.10
Picnicking	0.11	0.12	0.13	0.13	0.13	0.13	0.13	0.13
Nature walking	0.06	0.06	0.06	0.06	0.07	0.07	0.08	0.08
Hunting	0.09	0.06	0.04	0.04	0.04	0.04	0.03	0.03
Camping	0.24	0.39	0.44	0.42	0.41	0.38	0.38	0.38
Hiking	0.02	0.03	0.04	0.04	0.04	0.05	0.05	0.05
Total	3.52	4.17	4.59	4.69	4.78	4.81	4.81	4.80

---

* Excludes California residents.

Source: Stanford Research Institute.

By applying these per capita estimates to the estimated number of out-of-state visitors (Table 19), estimates of total demand exercised in the 11-county area by out-of-state visitors is obtained as shown in Table 22.

Table 22

PORTION OF TOTAL ANNUAL POTENTIAL DEMAND OF OTHER U.S. RESIDENTS* FOR SELECTED RECREATION EXERCISED IN THE 11-COUNTY AREA

1950-2020

(In Millions of Participation Days)

Activity	1950	1960	1970	1980	1990	2000	2010	2020
Sunbathing and swimming	0.4	1.4	3.9	7.3	12.2	18.3	21.2	25.3
Sightseeing	1.1	2.7	6.6	12.6	20.7	31.5	37.6	45.9
Fishing	0.7	1.5	3.2	5.5	8.0	10.8	11.2	11.8
Boating	0.1	0.3	0.9	1.7	2.7	4.4	5.3	6.4
Water skiing	†	0.1	0.3	0.6	1.0	1.6	1.9	2.2
Picnicking	0.1	0.2	0.5	0.9	1.4	2.1	2.4	2.9
Nature walking	†	0.1	0.2	0.4	0.8	1.1	1.5	1.8
Hunting	0.1	0.1	0.2	0.3	0.4	0.6	0.6	0.7
Camping	0.2	0.7	1.7	2.9	4.5	6.1	7.1	8.4
Hiking	†	†	0.2	0.3	0.4	0.8	0.9	1.1
Total	2.7	7.1	17.7	32.5	52.1	77.3	89.7	106.5

---

* Excludes California residents.

† Less than 0.05 million.

Source: Stanford Research Institute.

VII TOTAL POTENTIAL DEMAND OF ALL GROUPS

Individual estimates of the three population groups using recreational facilities of the area--11-county area residents, other California residents, and out-of-state visitors--were added to provide the total estimates shown in Table 23.

Median population projections and median per capita participation rates for 1970 to 2020 were used in preparing Table 23. Obviously, if the high population projections and participation rates had been used, high demands would have been estimated. To adjust the estimate of Table 23 to either the high or low population projection or high or low per capita participation rates, see Appendix A.

Preceding page blank

Table 23

PORTIONS OF TOTAL ANNUAL POTENTIAL DEMAND OF ALL GROUPS EXERCISED IN THE 11-COUNTY AREA BY ACTIVITIES*

1950-2020

(In Millions of Participation Days)

Activity	1950	1960	1970	1980	1990	2000	2010	2020
Sunbathing and swimming	12.4	27.3	48.1	63.0	90.1	114.9	136.3	153.9
Sightseeing	14.9	24.5	38.9	54.1	78.1	103.9	126.4	147.5
Fishing	5.8	9.1	13.5	17.2	22.4	26.9	28.2	28.3
Boating	4.2	7.4	11.3	15.4	21.8	28.9	35.8	41.9
Water skiing	0.8	2.1	3.8	5.1	7.4	9.6	11.5	13.0
Picnicking	7.2	11.5	17.0	21.3	29.0	36.0	42.8	48.0
Nature walking	4.2	5.8	8.0	10.6	15.1	19.6	25.2	30.6
Hunting	2.0	1.9	2.2	2.8	3.4	4.0	4.5	4.8
Camping	2.3	5.5	9.1	11.3	15.4	18.5	21.8	24.8
Hiking	1.3	2.7	4.8	6.5	9.3	12.2	14.7	16.5
Total	55.1	97.8	156.7	207.3	292.0	374.5	447.2	509.3

---

* Based on median population projections.

Source: Stanford Research Institute.

VIII TOTAL EXPECTED USE IN THE STUDY AREA

Estimates of recreation use for each activity, except fishing and hunting, with minor adaptations for certain activities due to information limitations, were developed in accordance with the following outline. (Estimates for fishing and hunting appear in Part 2.)

A. Total facilities available in the 11-county area. Estimates of the total facilities capable of accommodating a specific recreation activity were prepared primarily from an inventory of recreation facilities either available or planned by the California Department of Parks and Recreation.

B. Facilities available in the study area. Existing and planned facilities capable of accommodating a recreation activity were located and tabulated from maps provided by the Department of Parks and Recreation.

C. Per-unit use of facilities in the 11-county area (Item A). Using the same and supplemental sources, the existing use in terms of participation days per year per unit of facilities was prepared.

D. Total use that study area facilities can accommodate. The quantity of facilities capable of accommodating a specific recreation activity, identified as in the study area and shown in Item B, was multiplied by the estimate of use per unit of facilities reported under Item C. This provided an estimate of use in terms of participation days based on existing limitations in the supply of facilities.

E. Percentage of total 11-county area facilities in the study area. This is the calculated percentage that the quantity of facilities shown under Item B (existing in the study area) is of the quantity shown under Item A (existing in the 11-county area).

F. Total estimated use of facilities in the study area, assuming no limitation in facility supply. Data in Table 23 indicate the potential demand for specific recreation activities that would have been exercised in the 11-county area in 1960, assuming no limitation in the supply of facilities. This potential demand estimate is assumed to be distributed within the 11-county area in and beyond the study area in proportion to the distribution of existing and planned facilities for a specific recreation activity. Therefore, the estimates from Table 23 were multiplied by the percentage calculated in E.

If the above letters A through F are used to identify the data indicated and G is used to represent the respective potential demand estimate from Table 23, the relationships can be expressed as follows:

$$D = B\ C,$$

where D represents the total use that facilities in the study area can accommodate, and

$$F = G\ E = G\ (B/A),$$

where F represents the total use that would be made of facilities in the study area, assuming no limitation in facility supply.

Sunbathing and Swimming

Sunbathing and swimming are normally associated with each other. A typical sunbather occasionally takes a swim or a dip in the water, making himself also a swimmer. Other sunbathers merely wear swimming apparel while on the beach but classify themselves as swimmers. If a respondent in the 1960 National Recreation Survey[*] reported sunbathing as a separate outdoor recreation activity, his response was classified with many other activities under "miscellaneous activities." The following tabulation indicating the number of participation days reported on a per capita basis for the western population emphasizes the relative insignificance of sunbathing as a separate activity:

	Participation Days per Capita
Swimming	7.63
Miscellaneous activities including sunbathing	0.63

Within the 11-county area, there were 358 acres of beach plus 709,300 square feet of swimming pool space. It is estimated that 1,000 square feet of swimming pool space can be substituted for 0.862 acres of swimming beach, making possible conversion of the 709,300 square feet of swimming pool space to 61 acres of beach equivalent for a total of 419 acres of beach equivalent.

---

[*] Outdoor Recreation Resources Review Commission Study Report No. 1.

Although swimming pools are not of direct concern to this study, swimming pools along with beaches provide opportunities to participate in sunbathing and swimming and both must be considered in determining sites where participants will probably engage in these activities. Both types of facilities are therefore considered,in both the 11-county area and the study area. Recreation sites in the study area that provide opportunities for sunbathing and swimming are summarized in Table 24, although swimming pool beach equivalents account for only 2.8 percent of the study area total.

California Department of Parks and Recreation estimates that an acre of beach can accommodate 580 swimmers or sunbathers at a time and that the daily turnover is 2 to 2.5. Taking into consideration seasonal and weekly variations in use, the department also estimates that a beach area will be used 70 to 75 days a year. Thus, one acre of beach could accommodate 83,900 swimmers or sunbathers a year. These figures are statewide averages, however. The length of the swimming season on Northern California beaches is less than the 70-to-75 day state average. In this study, it is assumed that the season in the 11-county area is 55 to 60 days, or 20 percent shorter than the state average. Thus a Northern California beach could accommodate 67,100 swimmers or sunbathers per acre per year. Because of water temperatures in San Francisco Bay and other Northern California areas, a high percentage of these participants may be sunbathers rather than swimmers.

In Tables 25 and 26 the estimate of sunbathing and swimming in terms of participation days is developed for 1960 and projected for future years.

Table 24

RECREATION SITES WITH SUNBATHING AND SWIMMING FACILITIES
1960

Region	Total Recreation Sites	Sites with Swimming Facilities	Beaches (acres)	Swimming Pools		Total Beaches and Pools in Beach Equivalents (acres)
				Square Feet	Beach Equivalent (acres)*	
San Francisco Bay						
South	16	3	45	6,000	0.5	45.5
Central	19	3	7	5,300	0.5	7.5
Subtotal	35	6	52	11,300	1.0	53.0
San Pablo Bay	4	0	0	0	0	0
Suisun Bay	4	0	0	0	0	0
Delta Area	19	5	4	7,500	0.6	4.6
Total	62	11	56	18,800	1.6	57.6

---

* One thousand square feet of swimming pool equals 0.862 acre of beach.

Source: California Department of Parks and Recreation.

Table 25

SUNBATHING AND SWIMMING
DEVELOPMENT OF 1960 RECREATION USE ESTIMATES

A. Total facilities available in 11-county area	419.1 acres*
B. Facilities available in the study area	57.4 acres*
C. Use of facilities per year per unit in terms of units identified in A	67,100 participation days per acre
D. Total recreation use that facilities in study area can accommodate (B times C)	3.86 million participation days
E. Percent of total facilities in 11-county area that is in study area (B divided by A times 100)	13.7 percent
F. Total use that would be made of facilities in study area, assuming no limitation in facility supply (E times potential demand from Table 23)	3.74 million participation days

---

* Acres of beach equivalents, 1,000 square feet of swimming pool equals 0.862 acre of beach.

Table 26

SUNBATHING AND SWIMMING
PROJECTIONS OF EXPECTED RECREATION USE*
1950-2020
(In Millions)

	Existing Facility Supply Level†		Without Limitations of Facilities	
Year	Participation Days	Recreation Hours‡	Participation Days	Recreation Hours‡
1950	1.7	5.1	1.7	5.1
1960	3.7	11.1	3.7	11.1
1970	6.6	19.8	6.6	19.8
1980	8.6	25.8	8.6	25.8
1990	12.3	36.9	12.3	36.9
2000	15.7	47.1	15.7	47.1
2010	18.7	56.1	18.7	56.1
2020	21.1	63.8	21.1	63.8

---

* Based on median population projections and median per capita participation rate.

† Estimates based on assumption that the capabilities of facilities in the study area to satisfy demand in relative terms in 1960 would apply to the same degree in other years. Since estimate of demand based on consideration of existing supply exceeds estimate of demand developed without consideration of supply in Table 25, these figures are assumed to be the same as estimates of use without limitations of facilities.

‡ Estimated hours, assuming a participation of 3 hours for each participation day.

Sightseeing

Of the 26 natural preserves and parks in the 11-county area, three are in the study area. These three include 1,198 acres. Two of them (868 acres) are in the Central San Francisco Bay region; the other (330 acres) is in the Delta (see Table 27).

There are 50 vista points in the 11-county area, including three in the study area. Included in these three are 14 acres, or 14.1 percent of the total in the area. Other vista points located beyond the study area have been developed, at least in part, for a view of the Bay.

Sightseeing in the 11-county area can be related to various natural or man-made attractions, including, in addition to the study area, the ocean, redwood and other forests, mountains and foothills, and various urban features. In view of the variety of sightseeing available, the previously computed 14.1 percent appears reasonable and has been applied to potential demand to obtain recreation use in the study area.

Table 27

NATURAL PRESERVES AND PARKS
IN 11-COUNTY AREA AND STUDY AREA*
1960

	Areas	Acres
In study area	3	1,198
Not in study area	23	33,492
Total in 11-county area	26	34,690

---

* Excludes local parks and recreation areas.

Source: California Department of Parks and Recreation.

Estimates and projections of sightseeing are shown in Tables 28 and 29.

Table 28

SIGHTSEEING
DEVELOPMENT OF 1960 RECREATION USE ESTIMATES

A. Total facilities available in 11-county area	99 vista-point acres
B. Facilities available in the study area	14 vista-point acres
C. Use of facilities per year per unit in terms of units identified in A*	246,000 participation days
D. Total use that facilities in study area can accommodate (B times C)*	3.45 million participation days
E. Percent of total facilities in 11-county area that is in study area (B divided by A times 100)	14.1 percent
F. Total use that would be made of facilities in study area assuming no limitation in facility supply (E times potential demand from Table 23)	3.45 million participation days

---

* No data available; total use assumed the same as F and use per unit assumed to be 246,000 recreation days per year per vista-point acre.

Table 29

SIGHTSEEING
PROJECTIONS OF EXPECTED RECREATION USE*
1950–2020
(In Millions)

	Existing Facility Supply Level †		Without Limitations of Facilities	
Year	Participation Days	Recreation Hours ‡	Participation Days	Recreation Hours ‡
1950	2.1	8.4	2.1	8.4
1960	3.5	14.0	3.5	14.0
1970	5.5	22.0	5.5	22.0
1980	7.6	30.4	7.6	30.4
1990	11.0	44.0	11.0	44.0
2000	14.6	58.4	14.6	58.4
2010	17.8	71.2	17.8	71.2
2020	20.8	83.2	20.8	83.2

---

* Based on median population projections and median per capita participation rate.

† Estimates based on assumption that the capabilities of facilities in the study area to satisfy demand in relative terms in 1960 would apply to the same degree in other years. Since estimate of demand based on consideration of existing supply exceeds estimate of demand developed without consideration of supply in Table 28, these figures are assumed to be the same as estimates of use without limitations of facilities.

‡ Estimated hours, assuming a participation of 4 hours for each participation day.

Boating

There were 18 marinas in the 11-county area, according to the inventory of the California Department of Parks and Recreation, with 3,180 boat slips or berths operated or administered by federal, state, and local governments. As shown in Table 30, 2,289 of these berths were in the study area.

An earlier inventory made by the California Division of Small Craft Harbors indicated a total of 221 marinas with 18,158 berths in the 11-county area, including marinas administered by government agencies and other agencies and private businesses. This larger figure includes private yacht clubs, fishing resorts primarily in the Delta, recreation marinas operated by private businesses, and a few facilities operated as repair yards and commercial fleet berths.

Since the objective of this project is to measure recreation use, the repair yards and commercial fleet berths were eliminated from consideration. Also because the Department of Parks and Recreation inventory is more current, figures for government administered marinas used in this report are taken from that source.

Table 30

RECREATION MOTOR BOATING FACILITIES IN THE STUDY AREA
1965

Region	Number of Berths in Marinas Administered By		Total Berths
	Government Agencies	Others	
San Francisco Bay			
South	1,128	2,372	3,500
Central	555	145	700
Subtotal	1,683	2,517	4,200
San Pablo Bay	0	820	820
Suisun Bay	496	959	1,455
Delta	108	5,313	5,421
Total	2,287	9,609	11,896

Source: California Department of Parks and Recreation and Division of Small Craft Harbors.

The California Department of Parks and Recreation estimates that one boat berth can support 260 participation days of motor boating a year. This estimate takes into consideration the possibility of multiple use of berths on peak days and the normal seasonal and weekly variations in motor boating. Thus, 11,896 berths might be expected to provide facilities for 3.09 million participation days. However, some of these boating participation days are used for fishing and have previously been included in the fishing participation day estimates. To avoid double counting of boat fishing, this activity must be eliminated from motor boating.

Table 31

COMPARISON OF PARTICIPATION DAYS IN BOATING AND FISHING
1965
(In Thousands of Participation Days)

Region	Fishing Total Fishing	 Boat Fishing	 Other Fishing	Motor Boating Total Boating	 Boat Fishing	 Other Boating
San Francisco Bay						
South	174	35	139	910	35	875
Central	337	124	213	182	124	58
Subtotal	511	159	352	1,092	159	933
San Pablo Bay	320	192	128	213	192	21
Suisun Bay	155	79	76	378	79	299
Delta	1,580	1,162	418	1,409	1,162	247
Total	2,566	1,592	974	3,092	1,592	1,500

Source: Stanford Research Institute.

However, other error may be introduced in eliminating fishing. A boat on a given day can be used for both fishing and boating and, therefore, may be counted twice, much as a park can be used for picnicking, nature walking, playing games, and other activities. An examination of the available information suggests that approximately half the people engaging in boat fishing also engage in other motor boating activities on the same day. Therefore, the estimates in Table 32 were prepared for use as a base in making projections.

Table 32

EXPECTED RECREATION USE IN MOTOR BOATING EXCLUDING BOAT FISHING 1965

Region	Participation Days (millions)	Percentage of Total
San Francisco Bay		
South	0.89	38.9%
Central	0.12	5.2
Subtotal	1.01	44.1%
San Pablo Bay	0.12	5.1
Suisun Bay	0.34	14.8
Delta	0.83	36.0
Total	2.30	100.0%

Source: Stanford Research Institute.

The estimates of participation days developed here on motor boating differ from similar estimates for other activities in that the motor boating estimates apply to 1965 instead of the 1960 base year. To make them comparable it was necessary to adjust the estimate to 1960. This was done by using the trend in annual potential demand for motor boating, a figure expected to increase from 6.5 million to 9.9 million days between 1960 and 1970. Assuming a straight line increase in per capita demand for this recreation by residents of the 11-county area, other California counties, and other parts of the country, 1965 estimates of per capita demand were obtained in terms of participation days. These per capita estimates were then multiplied by the estimated 1965 populations of these areas and added to obtain a total of approximately 8.3 million participation days.

Differences between the potential demand and recreation use shown in Table 33 are due primarily to two factors: (1) not all the potential demand is exercised and (2) part of the potential demand is exercised outside the study area.

Table 33

POTENTIAL DEMAND AND EXPECTED RECREATION USE MOTOR BOATING EXCLUDING BOAT FISHING 1960, 1965, and 1970

(In Millions of Participation Days)

Year	Potential Demand	Expected Recreation Use
1970	9.9	2.74
1965	8.3	2.30
1960	6.5	1.81

Source: Stanford Research Institute.

Comparison of Tables 31 and 32 indicates that about 25 percent of the estimated 260 participation days of motor boating a year (65 participation days) would probably be taken for boat fishing, leaving 195 days of motor boating other than boat fishing. This estimate of participation days (195) applied to the estimated number of berths in the study area (11,896 in 1965) produces an estimate of 2.32 million participation days, or approximately the same as developed in Table 32. Based on these estimates, projections in Table 34 were prepared for the existing facility supply level.

To estimate the amount of demand that would be exercised in the study area if there were no supply limitations, the total potential demand for boating in the 11-county area was divided between the study area portion and the balance of the 11-county area. To do this, the distribution of berths between the study area and balance of the 11-county area was examined. For example, only 71.5 percent of the government administered berths in the 11-county area are in the study area. There is a higher percentage of 11-county total berths administered by nongovernmental agencies in the study area--between 82 and 86 percent, depending on the classification of commercial fleet and repair facilities. Approximately 78 percent of the total recreation berths in the 11-county area are located in the study area, a figure used here to determine the portion of the total 11-county demand that would be exercised in the study area if there were no supply limitations.

There is also overlapping between motor boating and sailing in terms of the use of boat slips and berths. Possibly some of the boating referred to as "motor boating" through Table 35 would more properly be

Table 34

BOAT ACCESS AREA PARKING SPACES
1960 and 1970

Region	1960	1970
San Francisco Bay		
South	1,845	2,315
Central	350	500
Subtotal	2,195	2,815
San Pablo Bay	0	0
Suisun Bay	50	50
Delta	231	731
Total	2,476	3,596

Source: California Department of Parks and Recreation.

Table 35

MOTOR BOATING
DEVELOPMENT OF 1960 RECREATION USE ESTIMATES

A. Total facilities available in 11-county area	15,250 berths (1965)
B. Facilities available in the study area	11,896 berths (1965)
C. Use of facilities per year per unit in terms of units identified in A	195 participation days per berth
D. Total use that facilities in study area can accommodate (B times C)	2.30 million participation days (1965)
E. Percent of total facilities in 11-county area that is in study area (B divided by A times 100)	78.0 percent
F. Total use that would be made of facilities study area assuming no limitation in facility supply (E times potential demand from Table 23)	5.07 million participation days

classed as "sailing." This problem arose partly from many sail boats being equipped with motors. Nevertheless, there is additional sailing in the study area.

To obtain an estimate of sailing not included in the motor boating estimates, the California Department of Parks and Recreation estimate of 18.85 persons per parking space in boat access areas was used with the department's estimate that each parking space will accommodate 28 participation days of sailing. In either case, a major deficiency in facilities was indicated for 1960. The figure producing the larger estimate of recreation use was applied in this project.

An increase in facilities by at least a third is expected by 1970, according to development plans shown in Table 34. Nevertheless, there will still be a major deficiency in facilities.

Recreation use estimates for sailing that appear in Table 36 were based on figures appearing in Table 34. Further analysis of the inventories suggests, however, that an understatement of recreation use can be obtained by limiting the base for projection to government administered areas, as done in Table 36.

This analysis led to the estimate that total recreation use for sailing is probably 1.26 times that available from government facilities such as included in the inventory. Therefore, the 1960 base year figure of 0.07 million participation days was adjusted upward to 0.09 million, a figure used in the projections.

Table 36

SAILING
DEVELOPMENT OF 1960 RECREATION USE ESTIMATES

A. Total facilities available in 11-county area	4,400 parking spaces
B. Facilities available in the study area	2,476 parking spaces
C. Use of facilities per year per unit in terms of units identified in A	28 participation days per parking space
D. Total use that facilities in study area can accommodate (B times C)	0.07 million participation days
E. Percent of total facilities in 11-county area that is in study area (B divided by A times 100)	56.3 percent
F. Total use that would be made of facilities in study area assuming no limitation in facility supply (E times potential demand from Table 23)	0.51 million participation days

To obtain estimates of expected use for boating, the estimates developed for motor boating and sailing were added, as indicated in the following tabulation, using 1960 data for the example (in millions of participation days):

Activity	Existing Facility Supply Level	Without Limitations of Facilities
Motor boating	1.79	5.07
Sailing	0.09	0.51
Boating	1.88	5.58

Projections of these estimates appear in Table 37.

Table 37

BOATING EXCLUDING BOAT FISHING
PROJECTIONS OF EXPECTED RECREATION USE*
1950-2020
(In Millions)

	Existing Facility Supply Level †		Without Limitations of Facilities	
Year	Participation Days	Recreation Hours‡	Participation Days	Recreation Hours‡
1950	1.1	3.5	3.2	9.6
1960	1.9	5.7	5.6	16.8
1970	2.8	8.6	8.5	25.5
1980	3.9	11.8	11.6	34.8
1990	5.6	16.6	16.4	49.2
2000	7.3	22.1	21.8	65.3
2010	9.1	27.4	27.0	81.1
2020	10.4	31.1	31.5	94.5

---

* Based on median population projections and median per capita participation rate.

† Estimates based on assumption that the capabilities of facilities in the study area to satisfy demand in relative terms in 1960 would apply to the same degree in other years.

‡ Estimated hours, assuming a participation of 3 hours for each participation day.

Water Skiing

Water skiing is tied directly to the use of motor boats and outboard motors capable of maintaining about 20 knots. The availability of areas of suitable water surface is also a primary consideration. Good ski areas should have beaches and ample room to operate high speed boats, be relatively free of wind and barely submerged objects and floating debris.

Most water skiing is concentrated near the boat launching site, since high powered boats normally cannot operate far from a source of fuel supply. In general, the ocean is not suitable for water skiing. Therefore, in estimating the percentage of total potential demand for water skiing in the 11-county area that would be exercised in the study area, boat slips associated with the ocean were eliminated.

Information from the California Department of Parks and Recreation indicated that each boat slip or berth in government administered marinas or recreation areas would account for 220 participation days a year. This figure takes into consideration seasonal and weekly variations in water skiing.

A large part of the water skiing in the study area is concentrated in the Delta, data for which is shown in Table 38. Estimates of use are presented in Tables 39 and 40. In preparing projections, the expected increase in boating facilities by 1970 was considered.

Table 38

DISTRIBUTION OF ANNUAL WATER SKIING ACTIVITY
1960
(Thousands of Participation Days)

Water Skiing	Spring (Mar–May)	Summer (Jun–Aug)	Fall (Sep–Nov)	Winter (Dec–Feb)	Annual Total
From boats berthed at Delta resorts and yacht clubs	14.0	43.0	18.0	—	75.0
From boats launched in the Delta	26.0	97.5	38.5	5.0	167.0
From boats berthed at private docks in the Delta	2.5	7.5	3.0	—	13.0
Total water skiing	42.5	148.0	59.5	5.0	255.0

Source: California Department of Water Resources.

Table 39

WATER SKIING
DEVELOPMENT OF 1960 RECREATION USE ESTIMATES

A. Total facilities available in 11-county area	2,730 boat slips*
B. Facilities available in the study area	2,287 boat slips*
C. Use of facilities per year per unit in terms of units identified in A	220 participation days per slip
D. Total use that facilities in study area can accommodate (B times C)	0.50 million participation days
E. Percent of total facilities in 11-county area that is in study area (B divided by A times 100)	83.8 percent
F. Total use that would be made of facilities in study area assuming no limitation in facility supply (E times potential demand from Table 23)	1.76 million participation days

---

* Projections of water skiing are based on boat slips in government administered areas rather than on all areas with a corresponding higher use per year. This eliminates the need to adjust for berths and slips used for fishing as opposed to other boating activities.

Table 40

WATER SKIING
PROJECTIONS OF EXPECTED RECREATION USE[*]
1950-2020
(In Millions)

Year	Existing Facility Supply Level[†] Participation Days	Existing Facility Supply Level[†] Recreation Hours[‡]	Without Limitations of Facilities Participation Days	Without Limitations of Facilities Recreation Hours[‡]
1950	0.2	0.4	0.7	1.4
1960	0.5	1.0	1.7	3.4
1970	2.9	5.8	3.2	6.4
1980	3.9	8.0	4.3	8.7
1990	5.7	11.4	6.2	12.4
2000	7.4	15.0	8.0	16.0
2010	8.8	17.8	9.6	19.2
2020	10.0	20.2	10.9	21.8

---

[*] Based on median population projections and median per capita participation rate

[†] Estimates based on assumption that the capabilities of facilities in the study area to satisfy demand in relative terms in 1960 would apply to the same degree in other years.

[‡] Estimated hours, assuming a participation of 2 hours for each participation day.

Picnicking

There were 10,369 picnic tables in the 11-county area in 1960. Of these, only 538 were in the study area (See Table 41).

Table 41

RECREATION SITES WITH PICNIC FACILITIES
1960

Region	Total Recreation Sites	Sites with Picnic Facilities	Acres in Picnic Areas	Picnic Tables
San Francisco Bay				
South	16	4	18	112
Central	19	5	12	109
Subtotal	35	9	30	221
San Pablo Bay	4	2	1	17
Suisun Bay	4	0	0	0
Delta	19	7	10	300
Total	62	18	41	538

Source: California Department of Parks and Recreation.

Known plans indicate there will be 950 picnic tables in the study area by 1970. Similar plans indicate that the 11-county area total will have been increased to 17,900. The study area, therefore, will continue to account for about 5.2 percent of the 11-county total.

One picnic table can accommodate 206 parties of 4 persons, each, during a year, according to information obtained from the California Department of Parks and Recreation. This use figure takes into consideration normal seasonal and weekly variations in demand. Based on this estimate, the number of tables available in 1960 would accommodate only 0.44 million participation days and the tables available in 1970 will accommodate only 77,000 participation days. Estimates of future use based on these benchmarks appear in Tables 42 and 43.

Table 42

PICNICKING
DEVELOPMENT OF 1960 RECREATION USE ESTIMATES

A. Total facilities available in 11-county area	10,369 picnic tables
B. Facilities available in the study area	538 picnic tables
C. Use of facilities per year per unit in terms of units identified in A	824 participation days per table
D. Total use that facilities in study area can accommodate (B times C)	0.44 million participation days
E. Percent of total facilities in 11-county area that is in study area (B divided by A times 100)	5.2 percent
F. Total use that would be made of facilities in study area assuming no limitation in facility supply (E times potential demand from Table 23)	0.60 million participation days

Table 43

PICNICKING
PROJECTIONS OF EXPECTED RECREATION USE*
1950–2020
(In Millions)

Year	Existing Facility Supply Level†		Without Limitations of Facilities	
	Participation Days	Recreation Hours‡	Participation Days	Recreation Hours‡
1950	0.3	0.5	0.4	0.6
1960	0.4	0.6	0.6	0.9
1970	0.8	1.1	0.9	1.4
1980	1.0	1.4	1.1	1.7
1990	1.3	1.8	1.5	2.3
2000	1.6	2.3	1.9	2.9
2010	1.9	2.7	2.2	3.3
2020	2.1	3.0	2.5	3.8

---

* Based on median population projections and median per capita participation rate.

† Estimates based on assumption that the capabilities of facilities in the study area to satisfy demand in relative terms in 1960 would apply to the same degree in other years.

‡ Estimated hours assuming a participation of 1.5 hours for each participation day.

Nature Walking

Although hiking trails can be used for nature walks, the length of the trail and the time involved for a walk is less. Each mile of hiking trails in the 11-county area can accommodate approximately 5,950 hikers a year. The same mileage, assuming frequent and ready access by the participants, can accommodate at least 15,000 nature walkers. There were no hiking trails in the study area in 1960, however, although 5 miles of trails should be available by 1970.

Nature walks, however, are not limited to hiking trails. There are 34,690 acres of natural preserves and parks in the 11-county area that could be used for nature walks. Some parts of the larger recreation areas may not be accessible to nature walkers. The estimates of nature walking equivalents in Table 44 were used in allocating nature walking.

Table 44

ESTIMATE OF ACREAGES USED FOR NATURE WALKING, BY SIZE OF AREAS 1960

	Total Acreage		Percent Usable For Nature Walks	Nature Walk Equivalents (acres)	
	11-County Area	Study Area		11-County Area	Study Area
0-499 acres	4,441	460	100%	4,441	460
500-999 acres	1,584	738	90	1,403	642
1,000-4,999	10,866	0	80	8,693	0
5,000-9,999	5,364	0	65	3,487	0
10,000 and over	12,435	0	50	6,218	0
Totals	34,690	1,198		24,242	1,102

Source: Based on data obtained from the California Department of Parks and Recreation.

Of the total nature walk equivalents in the 11-county area, 4.5 percent were in the study area. Estimates and projection of use appear in Tables 45 and 46.

Table 45

NATURE WALKING
DEVELOPMENT OF 1960 RECREATION USE ESTIMATES

A. Total facilities available in 11-county area	24,242 acre equivalent
B. Facilities available in the study area	1,102 acre equivalent
C. Use of facilities per year per unit in terms of units identified in A	240 participation days per acre equivalent
D. Total use that facilities in study area can accommodate (B times C)	0.26 million participation days
E. Percent of total facilities in 11-county area that **is** in study area (B divided by A times 100)	4.5 percent
F. Total use that would be made of facilities in study area assuming no limitation in facility supply (E times potential demand from Table 23)	0.26 million participation days

Table 46

NATURE WALKING
PROJECTIONS OF EXPECTED RECREATION USE*
1950-2020
(In Millions)

	Existing Facility Supply Level†		Without Limitations of Facilities	
Year	Participation Days	Recreation Hours‡	Participation Days	Recreation Hours‡
1950	0.2	0.4	0.2	0.4
1960	0.3	0.5	0.3	0.5
1970	0.4	0.7	0.4	0.7
1980	0.5	0.9	0.5	0.9
1990	0.7	1.3	0.7	1.3
2000	0.9	1.7	0.9	1.7
2010	1.1	2.3	1.1	2.3
2020	1.4	2.8	1.4	2.8

---

* Based on median population projections and median per capita participation rate.

† Estimates based on assumption that the capabilities of facilities in the study area to satisfy demand in relative terms in 1960 would apply to the same degree in other years. Since estimate of demand based on consideration of existing supply exceeds estimate of demand developed without consideration of supply in Table 45, these figures are assumed to be the same as estimates of use without limitations of facilities.

‡ Estimated hours assuming a participation of 2 hours for each participation day.

Camping

There are no campsites on San Francisco, San Pablo, and Suisun bays and only a very few in the Delta. Only 100 campsites were reported in the entire study area in 1960, although there were 800 in the 11-county area. In both cases, the supply of facilities was inadequate for the demand. The distribution of campsites in the study area is shown in Table 47.

Table 47

RECREATION SITES WITH CAMPING FACILITIES
1960

Region	Total Recreation Sites	Sites with Camping Facilities	Acres in Camping Areas	Camp Sites in 1960	Expected Camp Sites in 1970
San Francisco Bay					
South	16	0	0	0	0
Central	19	0	0	0	0
Subtotal	35	0	0	0	0
San Pablo Bay	4	0	0	0	0
Suisun Bay	4	0	0	0	0
Delta	19	1	18	100	331
Total	62	1	18	100	331

Source: California Department of Parks and Recreation.

One campsite will accommodate parties of four people on 128 nights of the year. This allows the 100 campsites to accommodate only 0.05 million participation days of camper use. Estimates of use and projections of demand appear in Tables 48 and 49. The expected development of new campsites shown in Table 48 is taken into consideration in Table 50.

Table 48

CAMPING
DEVELOPMENT OF 1960 RECREATION USE ESTIMATES

A. Total facilities available in 11-county area	800 campsites
B. Facilities available in the study area	100 campsites
C. Use of facilities per year per unit in terms of units identified in A	512 participation days per campsite
D. Total use that facilities in study area can accommodate (B times C)	0.05 million participation days
E. Percent of total facilities in 11-county area that is in study area (B divided by A times 100)	12.5 percent
F. Total use that would be made of facilities in study area assuming no limitation in facility supply (E times potential demand from Table 23)	0.69 million participation days

Table 49

CAMPING
PROJECTIONS OF EXPECTED RECREATION USE*
1950-2020
(In Millions)

	Existing Facility Supply Level †		Without Limitations of Facilities	
Year	Participation Days	Recreation Hours ‡	Participation Days	Recreation Hours ‡
1950	§	0.5	0.3	7.2
1960	0.1	1.2	0.7	16.8
1970	0.2	2.4	1.1	26.4
1980	0.2	4.8	1.4	33.6
1990	0.3	6.8	1.9	45.6
2000	0.3	7.2	2.3	55.2
2010	0.4	9.6	2.7	64.8
2020	0.5	12.0	3.1	74.4

---

* Based on median population projections and median per capita participation rate.

† Estimates based on assumption that the capabilities of facilities in the study area to satisfy demand in relative terms in 1960 would apply to the same degree in other years.

‡ Estimated hours assuming a participation of 24 hours for each participation day.

§ Less than 0.05 million.

Hiking

No hiking trails were reported in the study area in 1960, although development plans show there will be 5 miles of trails in the Delta by 1970. There were 165 miles of hiking trails in the 11-county area in 1960, with 223 miles expected by 1970. Projections of use are based on 1970 facilities rather than 1960 because of the complete lack of facilities in the study area in 1960.

One mile of hiking trail can accommodate 40 people at a time, according to estimates by the California Department of Parks and Recreation. Allowing for normal seasonal and weekly variations in hiking, the department also estimates that one mile of trail should accommodate 5,950 people per year.

Estimates and projection of use appear in Tables 50 and 51.

Table 50

HIKING
DEVELOPMENT OF 1960 RECREATION USE ESTIMATES

A. Total facilities available in 11-county area	165 trail miles
B. Facilities available in the study area	0 trail miles
C. Use of facilities per year per unit in terms of units identified in A	5,950 participation days per trail mile
D. Total use that facilities in study area can accommodate (B times C)	--
E. Percent of total facilities in 11-county area that **is** in study area (B divided by A times 100)	2.2 percent*
F. Total use that would be made of facilities in study area assuming no limitation in facility supply (E times potential demand from Table 23)	0.06 million participation days

---

* Based on 1970 development plans rather than on 1960 data.

Table 51

HIKING
PROJECTIONS OF EXPECTED RECREATION USE*
1950–2020
(In Millions)

	Existing Facility Supply Level †		Without Limitations of Facilities	
Year	Participation Days	Recreation Hours ‡	Participation Days	Recreation Hours ‡
1950	§	§	§	0.1
1960	§	§	0.1	0.2
1970	§	0.1	0.1	0.3
1980	§	0.1	0.1	0.4
1990	0.1	0.2	0.2	0.6
2000	0.1	0.2	0.3	0.8
2010	0.1	0.3	0.3	1.0
2020	0.1	0.3	0.4	1.1

---

* Based on median population projections and median per capita participation rate.

† Estimates based on assumption that the capabilities of facilities in the study area to satisfy demand in relative terms in 1960 would apply to the same degree in other years.

‡ Estimated hours assuming a participation of 3 hours for each participation day.

§ Less than 0.05 million.

All Activities*

The potential demand for all 10 recreation activities in the study area in 1960 was 22.0 million participation days. As shown in Table 52, this figure is expected to increase to 108.7 million by 2020. The facilities available, however, will probably not meet this entire demand. Limitations of needed facilities, primarily for water skiing and boating but to a lesser extent for certain other activities, resulted in a total use of 13.1 million participation days in 1960 (Table 53).

Plans indicate that some of the facility deficiencies will be eliminated by 1970. If these planned facilities are developed, the use in 1970 will total 22.9 participation days. If they are not and if the ratio of facilities to demand remains as it was in 1960, the 1970 total use will be slightly less than 18.0 million participation days. Assuming the development of facilities according to plans and the resulting 1970 ratio of facilities to demand maintained through 2020, recreation use is expected to reach 75.7 million participation days by 2020 (Figure 6).

These distant future projections may involve more facilities than can be developed. Sunbathing and swimming are an example. Use in the study area for sunbathing and swimming in 1960 was 3.7 million participation days, requiring 57.4 acres of beach. The requirement by 1970 will be 98.4 acres, but by 2020 the acres of beach needed for 21.1 million participation days of sunbathing and swimming will be 314, a quantity that may be impossible to develop.

---

* Including subsection figures developed for hunting and fishing.

Table 52

SUMMARY OF POTENTIAL DEMAND, BY RECREATION ACTIVITY OR OF RECREATION USE, ASSUMING NO LIMITATION IN SUPPLY OF FACILITIES
1950–2020
(Millions of Participation Days)

Activity	1950	1960	1970	1980	1990	2000	2010	2020
Sunbathing and swimming	1.7	3.7	6.6	8.6	12.3	15.7	18.7	21.1
Sightseeing	2.1	3.5	5.5	7.6	11.0	14.6	17.8	20.8
Fishing	2.9	4.5	6.7	8.5	11.1	13.3	13.9	14.0
Boating †	3.2	5.6	8.5	11.6	16.4	21.8	27.0	29.5
Water skiing	0.7	1.7	3.2	4.3	6.2	8.0	9.6	10.6
Picnicking	0.4	0.6	0.9	1.1	1.5	1.9	2.2	2.5
Nature walking	0.2	0.3	0.4	0.5	0.7	0.9	1.1	1.4
Hunting	1.4	1.3	1.5	1.9	2.4	2.8	3.1	3.3
Camping	0.3	0.7	1.1	1.4	1.9	2.3	2.7	3.1
Hiking	*	0.1	0.1	0.1	0.2	0.3	0.3	0.4
Total	12.9	22.0	34.5	45.6	63.7	80.7	96.4	108.7

---

* Less than 0.05 million.
† Except boat fishing.

Source: Stanford Research Institute.

Table 53

SUMMARY OF EXPECTED RECREATION USE BY ACTIVITY ASSUMING CONTINUED DEVELOPMENT OF FACILITIES AT PRESENT LEVEL OF DEMAND SATISFACTION

1950–2020

(Millions of Participation Days)

Activity	1950	1960	1970	1980	1990	2000	2010	2020
Sunbathing and swimming	1.7	3.7	6.6	8.6	12.3	15.7	18.7	21.1
Sightseeing	2.1	3.5	5.5	7.6	11.0	14.6	17.8	20.8
Fishing	1.9	2.6	3.6	4.4	5.8	7.0	8.3	9.2
Boating*	1.1	1.9	2.8	3.9	5.6	7.3	9.1	10.4
Water skiing	0.2	0.5	2.9	3.9	5.7	7.4	8.8	10.0
Picnicking	0.3	0.4	0.8	1.0	1.3	1.6	1.9	2.1
Nature walking	0.2	0.3	0.4	0.5	0.7	0.9	1.1	1.4
Hunting†	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Camping	*	0.1	0.2	0.2	0.3	0.3	0.4	0.5
Hiking	‡	‡	‡	‡	0.1	0.1	0.1	0.1
Total	7.6	13.1	22.9	30.2	42.5	55.0	66.3	75.7

---

* Excludes boat fishing.

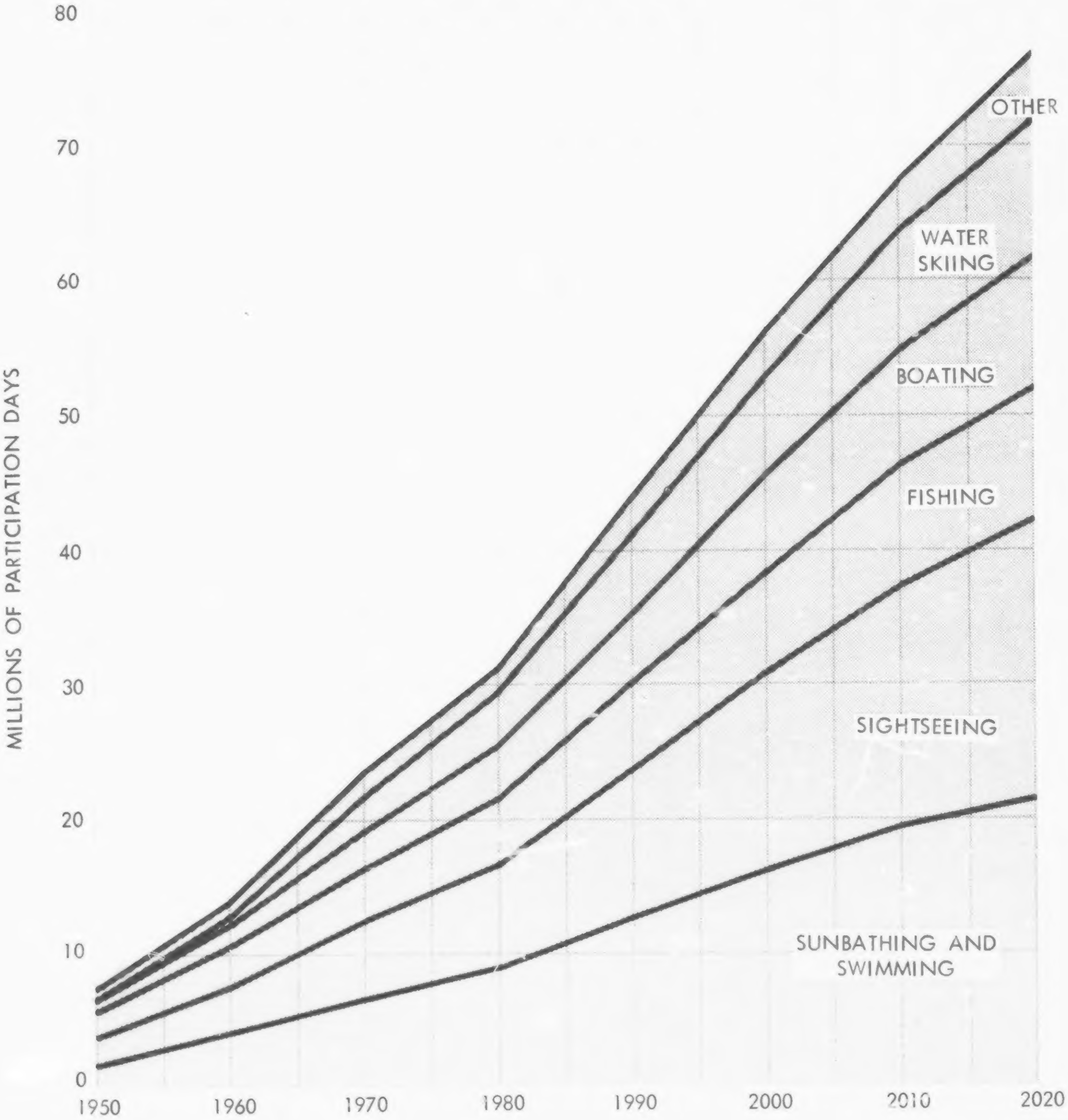
† Waterfowl only.

‡ Less than 0.05 million.

Source: Stanford Research Institute.

FIGURE 6

TOTAL RECREATION USE, BY TYPE OF PARTICIPANT AND TYPE OF RECREATION ACTIVITY



IX PRESENT RECREATION USE BY ACTIVITY, REGION, AND TYPE OF PARTICIPANT

Analysis of the long run trend in per capita potential demand for outdoor recreation activities, influences of changes in population mobility on sites where recreation demand will be exercised, trends in the population growth rate, and the development and expansion of facilities between 1960 and 1965 produced the estimates of 1965 recreation use in the study area that appear in Table 54.

Table 54

ESTIMATES OF PRESENT RECREATION USE BY ACTIVITY
1965

Activity	Participation Days (millions)
Sunbathing and swimming	5.01
Sightseeing	4.38
Fishing	3.40
Boating*	2.41
Water skiing	1.61
Picnicking	0.60
Nature walking	0.30
Hunting (waterfowl)	0.12
Camping	0.10
Hiking	0.02
Total	17.95

---

*Excludes boat fishing.

Source: Stanford Research Institute.

Based on information concerning the distribution of facilities in the study area presented in Section III, the recreation use figures in Table 54 were allocated to the various subareas or regions as is done in Table 55.

Table 55

ESTIMATES OF PRESENT RECREATION USE
BY ACTIVITY AND REGION
1965
(In Millions of Participation Days)

Activity	San Francisco Bay South	San Francisco Bay Central	San Pablo Bay	Suisun Bay Area	Delta Area
Sunbathing and swimming	3.68	0.63	0.30	0.05	0.35
Sightseeing	0.75	1.96	0.36	0.36	0.95
Boating*	0.95	0.14	0.13	0.34	0.85
Water skiing	0.40	0.36	0.27	0.12	0.46
Picnicking	0.13	0.12	0.02	†	0.33
Nature walking	0.13	0.08	0.01	†	0.08
Camping	†	†	†	†	0.10
Hiking	†	†	†	†	0.02
Total, excluding fishing and hunting	6.04	3.27	1.09	0.87	3.14

---

* Excludes boat fishing.
† Less than 0.05 million.

Estimates of potential demand (as opposed to recreation use) to be exercised in the study water area were provided by activity in Section II. On the assumption that the ratio of recreation use to potential demand is the same for all types of participants, the present estimates were broken down by types of participants. These breakdowns are shown in Table 56.

Table 56

ESTIMATES OF PRESENT RECREATION USE BY ACTIVITY AND TYPE OF PARTICIPANT
1965
(In Millions of Participation Days)

Activity	Type of Participant		
	11-County Area Residents	Other California Residents	Other U.S. Residents
Sunbathing and swimming	3.54	1.13	0.34
Sightseeing	2.82	0.93	0.63
Boating*	1.71	0.57	0.13
Water skiing	1.11	0.38	0.12
Picnicking	0.43	0.15	0.02
Nature walking	0.22	0.07	0.01
Camping	0.06	0.02	0.02
Hiking	0.01	0.01	†
Total, excluding fishing and hunting	9.27	3.26	1.28

---

* Excludes boat fishing.
† Less than 0.05 million.

X BREAKDOWN OF PROJECTIONS BY ACTIVITY, REGION, AND TYPE OF PARTICIPANT

Projections of recreation use for each of the 10 activities were broken down by region, using information developed in preceding sections, and further broken down in each region by type of participant.

Tables 57 through 67 show these projections by recreation activity. Table 67 and Figure 7 show summaries of the projections by type of participant.

Estimates in these tables were made to the nearest hundredth of a million recreation days instead of to the nearest tenth of a million in the preceding sections. The difference does not imply more accuracy. This detail was used to allow development of figures for many breakdowns that would have been impossible with a tenth of a million base.

Preceding page blank

Table 57

ESTIMATED EXPECTED SUNBATHING AND SWIMMING USE, BY TYPE OF PARTICIPANT AND REGION*

1950–2020

(Millions of Participation Days)

Region and Type of Participant	1950	1960	1970	1980	1990	2000	2010	2020
Study area total								
All participants	1.70	3.74	6.59	8.63	12.34	15.74	18.67	21.08
11-county residents	1.29	2.71	4.59	5.67	8.12	10.26	12.36	13.64
Other California residents	0.36	0.84	1.47	1.96	2.55	2.98	3.42	3.97
Other U.S. residents	0.05	0.19	0.53	1.00	1.67	2.50	2.89	3.47
South San Francisco Bay†								
All participants	1.25	2.74	4.84	6.33	9.06	11.55	13.70	15.47
11-county residents	0.95	1.99	3.37	4.16	5.96	7.53	9.07	10.01
Other California residents	0.26	0.61	1.08	1.44	1.87	2.18	2.51	2.91
Other U.S. residents	0.04	0.14	0.39	0.73	1.23	1.84	2.12	2.55
Central San Francisco Bay†								
All participants	0.21	0.47	0.82	1.08	1.54	1.97	2.33	2.64
11-county residents	0.16	0.34	0.57	0.71	1.01	1.29	1.54	1.71
Other California residents	0.04	0.11	0.18	0.24	0.32	0.37	0.43	0.50
Other U.S. residents	0.01	0.02	0.07	0.13	0.21	0.31	0.36	0.43
San Pablo Bay								
All participants	0.10	0.22	0.40	0.52	0.74	0.94	1.12	1.26
11-county residents	0.08	0.16	0.28	0.34	0.49	0.61	0.74	0.82
Other California residents	0.02	0.05	0.09	0.12	0.15	0.18	0.21	0.24
Other U.S. residents	§	0.01	0.03	0.06	0.10	0.15	0.17	0.20
Suisun Bay‡								
All participants	0.02	0.04	0.06	0.09	0.12	0.16	0.19	0.21
11-county residents	0.01	0.03	0.04	0.06	0.08	0.10	0.13	0.14
Other California residents	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.04
Other U.S. residents	§	§	§	0.01	0.02	0.03	0.03	0.03
Delta								
All participants	0.12	0.27	0.47	0.61	0.88	1.12	1.33	1.50
11-county residents	0.09	0.20	0.33	0.40	0.58	0.73	0.88	0.97
Other California residents	0.03	0.06	0.10	0.14	0.18	0.21	0.21	0.28
Other U.S. residents	§	0.01	0.04	0.07	0.12	0.18	0.21	0.25

---

* Based on median population projections and median per capita participation rates.

† South San Francisco Bay is the area south of Oakland Bay Bridge; Central San Francisco Bay is the area north of the Bridge.

‡ For the purpose of this table, Suisun Bay also includes Grizzly Bay and Carquinez Straits.

§ Less than 0.005 million.

Table 58

ESTIMATED EXPECTED SIGHTSEEING USE, BY TYPE OF PARTICIPANT AND REGION*
1950–2020
(Millions of Participation Days)

Region and Type of Participant	1950	1960	1970	1980	1990	2000	2010	2020
Study area total								
All participants	2.10	3.45	5.48	7.62	11.00	14.63	17.80	20.77
11-county residents	1.50	2.32	3.41	4.28	6.08	7.81	9.70	10.97
Other California residents	0.44	0.75	1.14	1.56	2.00	2.38	2.81	3.34
Other U.S. residents	0.16	0.38	0.93	1.78	2.92	4.44	5.29	6.46
South San Francisco Bay†								
All participants	0.35	0.58	0.92	1.27	1.84	2.44	2.97	3.47
11-county residents	0.25	0.39	0.57	0.71	1.02	1.30	1.62	1.83
Other California residents	0.07	0.13	0.19	0.26	0.33	0.40	0.47	0.56
Other U.S. residents	0.03	0.06	0.16	0.30	0.49	0.74	0.88	1.08
Central San Francisco Bay†								
All participants	0.94	1.55	2.45	3.41	4.93	6.55	7.97	9.31
11-county residents	0.67	1.03	1.54	1.92	2.72	3.50	4.33	4.92
Other California residents	0.20	0.34	0.50	0.70	0.90	1.06	1.26	1.50
Other U.S. residents	0.07	0.18	0.41	0.79	1.31	1.99	2.38	2.89
San Pablo Bay								
All participants	0.18	0.29	0.46	0.64	0.92	1.23	1.50	1.74
11-county residents	0.13	0.20	0.28	0.36	0.51	0.66	0.82	0.92
Other California residents	0.04	0.06	0.10	0.13	0.17	0.20	0.24	0.28
Other U.S. residents	0.01	0.03	0.08	0.15	0.24	0.37	0.44	0.54
Suisun Bay‡								
All participants	0.17	0.28	0.46	0.64	0.91	1.22	1.48	1.72
11-county residents	0.13	0.19	0.28	0.36	0.50	0.65	0.81	0.91
Other California residents	0.03	0.06	0.10	0.13	0.17	0.20	0.23	0.27
Other U.S. residents	0.01	0.03	0.08	0.15	0.24	0.37	0.44	0.54
Delta								
All participants	0.46	0.75	1.19	1.66	2.40	3.19	3.88	4.53
11-county residents	0.32	0.51	0.74	0.93	1.33	1.70	2.12	2.39
Other California residents	0.10	0.16	0.25	0.34	0.43	0.52	0.61	0.73
Other U.S. residents	0.04	0.08	0.20	0.39	0.64	0.97	1.15	1.44

---

* Based on median population projections and median per capita participation rates.

† South San Francisco Bay is the area south of Oakland Bay Bridge; Central San Francisco Bay is the area north of the Bridge.

‡ For the purpose of this table, Suisun Bay also includes Grizzly Bay and Carquinez Straits.

Table 59

ESTIMATED EXPECTED FISHING USE, BY TYPE OF PARTICIPANT AND REGION*
1950–2020
(Millions of Participation Days)

Region and Type of Participant	1950	1960	1970	1980	1990	2000	2010	2020
Study area total								
All participants	1.91	2.57	3.60	4.38	5.82	5.82	6.97	9.17
11-county residents	1.25	1.55	2.00	2.12	2.73	2.73	3.11	3.95
Other California residents	0.43	0.59	0.75	0.86	1.02	1.02	1.06	1.40
Other U.S. residents	0.23	0.42	0.85	1.40	2.08	2.79	2.79	3.82

Note: This table is based on figures developed by John Skinner. Breakdowns are not provided for regions within the study area. Estimate for 1950 was made by extending Skinner's 1960 estimate backwards on the basis of number of fishing licenses sold. Breakdown by type of participant made by applying breakdowns of potential demand, by type of participant, to these use estimates.

* Based on median population projections and median per capita participation rates.

Table 60

ESTIMATED EXPECTED BOATING USE, BY TYPE OF PARTICIPANT AND REGION*
1950–2020
(Millions of Participation Days)

Region and Type of Participant	1950	1960	1970	1980	1990	2000	2010	2020
Study area total								
All participants	1.15	1.90	2.88	3.92	5.55	7.37	9.13	10.38
11-county residents	0.85	1.35	1.97	2.54	3.66	4.80	6.02	6.75
Other California residents	0.26	0.45	0.67	0.95	1.20	1.46	1.74	2.08
Other U.S. residents	0.04	0.10	0.24	0.43	0.69	1.11	1.37	1.55
South San Francisco Bay †								
All participants	0.47	0.76	1.15	1.56	2.20	2.92	3.63	4.13
11-county residents	0.34	0.53	0.78	1.01	1.44	1.91	2.39	2.69
Other California residents	0.11	0.18	0.27	0.38	0.48	0.58	0.69	0.83
Other U.S. residents	0.02	0.05	0.10	0.17	0.28	0.43	0.55	0.61
Central San Francisco Bay †								
All participants	0.06	0.11	0.17	0.22	0.31	0.42	0.51	0.59
11-county residents	0.04	0.08	0.12	0.14	0.21	0.27	0.34	0.38
Other California residents	0.02	0.03	0.04	0.06	0.07	0.08	0.09	0.12
Other U.S. residents	§	§	0.01	0.02	0.03	0.07	0.08	0.09
San Pablo Bay								
All participants	0.06	0.10	0.15	0.20	0.31	0.39	0.47	0.54
11-county residents	0.04	0.08	0.11	0.13	0.21	0.25	0.31	0.34
Other California residents	0.02	0.02	0.03	0.05	0.06	0.08	0.09	0.11
Other U.S. residents	§	§	0.01	0.02	0.03	0.06	0.07	0.09
Suisun Bay ‡								
All participants	0.16	0.27	0.40	0.55	0.79	1.04	1.29	1.46
11-county residents	0.12	0.20	0.28	0.36	0.52	0.68	0.85	0.95
Other California residents	0.04	0.06	0.09	0.13	0.17	0.21	0.25	0.29
Other U.S. residents	§	0.01	0.03	0.06	0.10	0.15	0.19	0.22
Delta								
All participants	0.40	0.66	1.01	1.39	1.95	2.61	3.23	3.66
11-county residents	0.31	0.47	0.68	0.90	1.28	1.69	2.13	2.39
Other California residents	0.07	0.15	0.24	0.33	0.42	0.51	0.62	0.73
Other U.S. residents	0.02	0.04	0.09	0.16	0.25	0.40	0.48	0.54

---

* Based on median population projections and median per capita participation rates.

† South San Francisco Bay is considered as the area south of the Oakland Bay Bridge; Central San Francisco Bay is considered as the area north of the Bridge.

‡ For the purpose of this table, Suisun Bay also includes Grizzly Bay and Carquinez Straits.

§ Less than 0.005 million.

Table 61

ESTIMATED EXPECTED WATER SKIING USE, BY TYPE OF PARTICIPANT AND REGION*
1950–2020
(Millions of Participation Days)

Region and Type of Participant	1950	1960	1970	1980	1990	2000	2010	2020
Study area total								
All participants	0.19	0.50	2.91	3.91	5.67	7.35	8.81	9.95
11-county residents	0.14	0.36	1.99	2.53	3.68	4.75	5.75	6.35
Other California residents	0.05	0.12	0.69	0.92	1.22	1.38	1.61	1.91
Other U.S. residents	§	0.02	0.23	0.46	0.77	1.22	1.45	1.69
South San Francisco Bay †								
All participants	0.05	0.12	0.72	0.96	1.40	1.81	2.17	2.45
11-county residents	0.04	0.09	0.49	0.62	0.91	1.17	1.41	1.56
Other California residents	0.01	0.03	0.17	0.23	0.30	0.34	0.40	0.47
Other U.S. residents	§	0.01	0.06	0.11	0.19	0.30	0.36	0.42
Central San Francisco Bay †								
All participants	0.04	0.11	0.65	0.87	1.26	1.64	1.97	2.22
11-county residents	0.03	0.08	0.44	0.56	0.82	1.06	1.28	1.14
Other California residents	0.01	0.03	0.15	0.21	0.27	0.31	0.37	0.43
Other U.S. residents	§	§	0.06	0.10	0.17	0.27	0.32	0.38
San Pablo Bay								
All participants	0.03	0.08	0.49	0.65	0.95	1.23	1.47	1.66
11-county residents	0.02	0.06	0.33	0.42	0.62	0.79	0.96	1.06
Other California residents	0.01	0.02	0.12	0.15	0.20	0.23	0.27	0.32
Other U.S. residents	§	§	0.04	0.08	0.13	0.21	0.24	0.28
Suisun Bay ‡								
All participants	0.02	0.04	0.23	0.31	0.44	0.57	0.69	0.78
11-county residents	0.01	0.03	0.16	0.20	0.29	0.37	0.45	0.50
Other California residents	0.01	0.01	0.05	0.07	0.10	0.11	0.13	0.15
Other U.S. residents	§	§	0.02	0.04	0.06	0.09	0.11	0.13
Delta								
All participants	0.05	0.14	0.83	1.12	1.62	2.10	2.52	2.85
11-county residents	0.04	0.10	0.57	0.73	1.05	1.36	1.65	1.82
Other California residents	0.01	0.03	0.20	0.26	0.35	0.39	0.44	0.55
Other U.S. residents	§	0.01	0.05	0.13	0.22	0.35	0.42	0.48

---

* Based on median population projections and median per capita participation rates.

† South San Francisco Bay is the area south of Oakland Bay Bridge; Central San Francisco Bay is considered as the area north of the Bridge.

‡ For the purpose of this table, Suisun Bay also includes Grizzly Bay and Carquinez Straits.

§ Less than 0.005 million.

Table 62

ESTIMATED EXPECTED PICNICKING USE, BY TYPE OF PARTICIPANT AND REGION*
1950–2020
(Millions of Participation Days)

Region and Type of Participant	1950	1960	1970	1980	1990	2000	2010	2020
Study area total								
All participants	0.28	0.44	0.77	0.96	1.31	1.63	1.94	2.17
11-county residents	0.22	0.32	0.56	0.67	0.94	1.18	1.41	1.56
Other California residents	0.06	0.11	0.19	0.25	0.31	0.36	0.42	0.48
Other U.S. residents	§	0.01	0.02	0.04	0.06	0.09	0.11	0.13
South San Francisco Bay†								
All participants	0.06	0.09	0.16	0.20	0.27	0.34	0.40	0.45
11-county residents	0.05	0.07	0.12	0.14	0.20	0.25	0.29	0.32
Other California residents	0.01	0.02	0.04	0.05	0.06	0.07	0.09	0.10
Other U.S. residents	§	§	§	0.01	0.01	0.02	0.02	0.02
Central San Francisco Bay†								
All participants	0.06	0.09	0.16	0.20	0.27	0.33	0.40	0.44
11-county residents	0.05	0.07	0.11	0.14	0.18	0.24	0.29	0.32
Other California residents	0.01	0.02	0.04	0.05	0.07	0.07	0.09	0.10
Other U.S. residents	§	§	0.01	0.01	0.02	0.02	0.02	0.02
San Pablo Bay								
All participants	0.01	0.01	0.03	0.03	0.04	0.05	0.06	0.07
11-county residents	0.01	0.01	0.02	0.02	0.03	0.04	0.04	0.05
Other California residents	§	§	0.01	0.01	0.01	0.01	0.01	0.01
Other U.S. residents	§	§	§	§	§	§	0.01	0.01
Suisun Bay‡								
All participants	§	§	§	§	0.01	0.01	0.01	0.01
11-county residents	§	§	§	§	0.01	0.01	0.01	0.01
Other California residents	§	§	§	§	§	§	§	§
Other U.S. residents	§	§	§	§	§	§	§	§
Delta								
All participants	0.15	0.24	0.42	0.53	0.72	0.90	1.07	1.20
11-county residents	0.11	0.18	0.31	0.37	0.52	0.65	0.78	0.86
Other California residents	0.04	0.06	0.10	0.14	0.17	0.20	0.23	0.27
Other U.S. residents	§	§	0.01	0.02	0.03	0.05	0.06	0.07

---

* Based on median population projections and median per capita participation rates.

† South San Francisco Bay is the area south of Oakland Bay Bridge; Central San Francisco Bay is the area north of the Bridge.

‡ For the purpose of this table, Suisun Bay also includes Grizzly Bay and Carquinez Straits.

§ Less than 0.005 million

Table 63

ESTIMATED EXPECTED NATURE WALKING USE, BY TYPE OF PARTICIPANT AND REGION*
1950–2020
(Millions of Participation Days)

Region and Type of Participant	1950	1960	1970	1980	1990	2000	2010	2020
Study area total								
All participants	0.19	0.26	0.36	0.48	0.68	0.88	1.13	1.37
11-county residents	0.15	0.19	0.26	0.34	0.49	0.65	0.84	1.00
Other California residents	0.04	0.06	0.09	0.12	0.15	0.18	0.22	0.29
Other U.S. residents	§	0.01	0.01	0.02	0.04	0.05	0.07	0.08
South San Francisco Bay†								
All participants	0.08	0.11	0.15	0.21	0.29	0.38	0.48	0.59
11-county residents	0.06	0.08	0.11	0.15	0.21	0.28	0.36	0.43
Other California residents	0.02	0.03	0.04	0.05	0.06	0.07	0.09	0.13
Other U.S. residents	§	§	§	0.01	0.02	0.03	0.03	0.04
Central San Francisco Bay†								
All participants	0.05	0.07	0.10	0.14	0.19	0.25	0.32	0.39
11-county residents	0.04	0.05	0.07	0.10	0.14	0.19	0.24	0.29
Other California residents	0.01	0.02	0.03	0.03	0.04	0.05	0.06	0.08
Other U.S. residents	§	§	§	0.01	0.01	0.01	0.02	0.02
San Pablo Bay								
All participants	0.01	0.01	0.01	0.01	0.03	0.03	0.04	0.05
11-county residents	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04
Other California residents	§	§	§	§	0.01	0.01	0.01	0.01
Other U.S. residents	§	§	§	§	§	§	§	§
Suisun Bay‡								
All participants	§	§	§	§	§	§	§	§
11-county residents	§	§	§	§	§	§	§	§
Other California residents	§	§	§	§	§	§	§	§
Other U.S. residents	§	§	§	§	§	§	§	§
Delta								
All participants	0.05	0.07	0.09	0.12	0.17	0.22	0.29	0.34
11-county residents	0.04	0.05	0.07	0.08	0.12	0.16	0.21	0.25
Other California residents	0.01	0.02	0.02	0.04	0.04	0.05	0.06	0.07
Other U.S. residents	§	§	§	§	0.01	0.01	0.02	0.02

---

* Based on median population projections and median per capita participation rates.

† South San Francisco Bay is the area south of Oakland Bay Bridge; Central San Francisco Bay is the area north of the Bridge.

‡ For the purpose of this table, Suisun Bay also includes Grizzly Bay and Carquinez Straits.

§ Less than 0.005 million.

Table 64

ESTIMATED EXPECTED WATERFOWL HUNTING USE, BY TYPE OF PARTICIPANT AND REGION*

1950–2020

(Millions of Participation Days)

Region and Type of Participant	1950	1960	1970	1980	1990	2000	2010	2020
Study area total								
All participants	0.12	0.12	0.13	0.14	0.14	0.14	0.14	0.14
11-county residents	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.08
Other California residents	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Other U.S. residents	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02

Note: This table is based on figures developed by John Skinner. Breakdowns are not provided for regions within the study area. Estimate for 1950 was made by extending Skinner's 1960 estimate backwards on the basis of estimates of non-deer hunting. Breakdown by type of participant made by applying breakdowns of potential demand by type of participant to these use estimates.

* Based on median population projections and median per capita participation rates.

Table 65

ESTIMATED EXPECTED CAMPING USE, BY TYPE OF PARTICIPANT AND REGION*
1950–2020
(Millions of Participation Days)

Region and Type of Participant	1950	1960	1970	1980	1990	2000	2010	2020
Study area total								
All participants	0.02	0.05	0.17	0.21	0.28	0.35	0.41	0.46
11-county residents	0.02	0.03	0.10	0.12	0.15	0.17	0.21	0.22
Other California residents	‡	0.01	0.04	0.04	0.05	0.06	0.07	0.08
Other U.S. residents	‡	0.01	0.03	0.05	0.08	0.12	0.13	0.16
Delta†								
All participants	0.02	0.05	0.17	0.21	0.28	0.35	0.41	0.46
11-county residents	0.02	0.03	0.10	0.12	0.15	0.17	0.21	0.22
Other California residents	‡	0.01	0.04	0.04	0.05	0.06	0.07	0.08
Other U.S. residents	‡	0.01	0.03	0.05	0.08	0.12	0.13	0.16

---

* Based on median population projections and median per capita participation rates.

† Camping is considered limited to the Delta.

‡ Less than 0.005 million.

Table 66

ESTIMATED EXPECTED HIKING USE, BY TYPE OF PARTICIPANT AND REGION*

1950–2020

(Millions of Participation Days)

Region and Type of Participant	1950	1960	1970	1980	1990	2000	2010	2020
Study area total								
All participants	‡	0.01	0.03	0.04	0.06	0.08	0.09	0.10
11–county residents	‡	0.01	0.02	0.03	0.05	0.05	0.06	0.07
Other California residents	‡	‡	0.01	0.01	0.01	0.02	0.02	0.02
Other U.S. residents	‡	‡	‡	‡	‡	0.01	0.01	0.01
Delta†								
All participants	‡	0.01	0.03	0.04	0.06	0.08	0.09	0.10
11–county residents	‡	0.01	0.02	0.03	0.05	0.05	0.06	0.07
Other California residents	‡	‡	0.01	0.01	0.01	0.02	0.02	0.02
Other U.S. residents	‡	‡	‡	‡	‡	0.01	0.01	0.01

---

* Based on median population projections and median per capita participation rates.

† Hiking with packs is considered as limited to the Delta.

‡ Less than 0.005 million.

Table 67

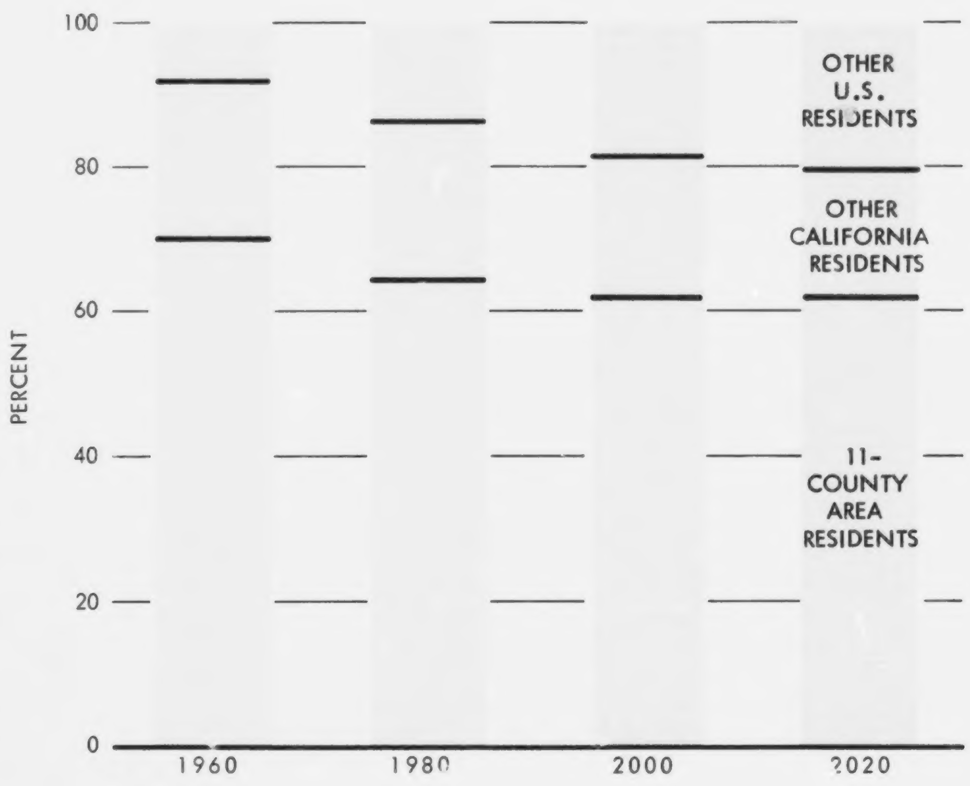
TOTAL EXPECTED RECREATION USE FOR ALL 10 ACTIVITIES IN THE STUDY AREA BY TYPE OF PARTICIPANT
1950-2020
(In Millions of Participation Days)

Type of Participant	1950	1960	1970	1980	1990	2000	2010	2020
11-county area residents	5.4	8.9	14.9	18.7	26.0	32.7	40.2	44.6
Other California residents	1.7	2.9	5.1	6.5	8.5	9.9	11.6	13.7
Other U.S. residents	0.5	1.3	2.9	5.0	8.4	12.4	14.6	17.4
Total	7.6	13.1	22.9	30.2	42.9	55.0	66.4	75.7

Source: Stanford Research Institute.

FIGURE 7

PERCENTAGE OF TOTAL RECREATION USE IN STUDY AREA, BY TYPE OF PARTICIPANT



PART 2

ESTIMATES OF FISHING AND HUNTING

Preceding page blank

XI SPORT FISHING

Seven major species are important in the sport fishery of San Francisco Bay and the Delta. The most important are striped bass and catfish, followed by salmon, shad, steelhead, largemouth black bass, sturgeon and miscellaneous species. Sport fishing is also done in the ocean and in streams tributary to the Bay and Delta. Practically all the salmon is caught either in the ocean or the Sacramento River. However, as considered herein fish caught outside the study area depend on the Bay and Delta in one way or another, as for example, safe passage to upstream spawning grounds.

There are both boat and shore fishing for most species. About half the salmon angling is either from party boats or from private and rental boats. The other half is Sacramento River angling. Almost all sturgeon are caught from boats--primarily party boats--and part of the striped bass angling is done from party boats. Most American shad are caught in rivers outside the study area. Steelheads are taken primarily in the upper Sacramento River.

The total amount of angling for sport purposes in 1960 was slightly more than 2.5 million participation days. Except for steelhead trout and shad, the principal demand for most species came from the 11-county area.

Several general assumptions were made for projection purposes, as well as a number of specific assumptions concerning particular species. The most important general assumptions regarded (1) the unchanging water quality of the Bay and Delta throughout the projection period, (2) the continuation of past trends in resource performance, and (3) the present policy and programs. This latter assumption was considered necessary because there appear to be no specific long-term programs and firm financial commitments to specific goals in resource improvement.

Although the projections could have been made in a number of ways, use per capita was the principal factor considered. This factor was believed to be more stable than other possible indexes of sport fishing. Because use varies widely from year to year, the average use for the period 1955-1964 was taken as the base for projections.

Since angler use is to some extent a function of the quality of the experience this was taken into consideration in preparing estimates of future use. Specific details are given for each species, and a summary of fishing use is given in Table 68.

Preceding page blank

Table 68

SUMMARY OF FISHING AND HUNTING USE
1960–2020
(Median Estimates in Thousands of Participation Days)

	1960	1970	1980	1990	2000	2010	2020
King Salmon							
Party boat angling	30	70	80	103	121	137	142
Private & rental boat angling	13	40	45	58	68	78	80
River angling	80	106	121	156	183	207	215
Total	123	216	246	317	372	422	437
Steelhead Trout							
Sacramento River system	40	46	51	56	61	66	71
SF Bay tributaries	4	4	4	3	3	2	2
Total	44	50	55	59	64	68	73
Striped Bass							
San Pablo Bay	167	235	287	379	447	538	594
Suisan Bay	76	105	128	169	199	240	265
Delta	786	1,137	1,383	1,834	2,159	2,600	2,870
Central SF Bay	167	239	291	386	455	547	604
South SF Bay	87	124	151	200	235	283	313
Ocean	56	83	101	134	158	191	210
Other areas	149	214	260	345	406	489	540
Total	1,487	2,137	2,600	3,447	4,058	4,887	5,395
Sturgeon	3	8	8	10	14	18	26
American Shad	50	125	200	275	350	425	500
Bay angling							
Central SF Bay	172	176	212	278	335	387	412
South SF Bay	149	152	182	239	287	332	353
Total	321	328	394	517	622	719	765
Catfish	448	612	732	996	1,238	1,491	1,646
Largemouth Black Bass	11	15	18	24	30	37	40
Unidentified Delta angling	79	108	129	176	218	263	290
Total fishing	2,566	3,599	4,382	5,821	6,966	8,330	9,172
Waterfowl							
San Pablo Bay	14.5	17	17	17	18	18	18
Central SF Bay	2.0	2	2	2	2	2	2
Suisun Bay	60.5	71	72	72	73	74	75
South SF Bay	18.5	24	24	25	25	25	26
Delta	23.0	21	22	22	22	22	23
Total waterfowl	118.5	135	137	138	140	141	144
Total hunting and fishing days	2,681.5	3,734	4,519	5,959	7,106	8,471	9,316

Most past estimates of use for hunting and angling have relied on postcard surveys. These surveys are useful in determining trends, but they are not generally accurate enough for determining use and catch. Surveys were not used as base data sources in this study, except in the case of waterfowl kill estimates, which were adjusted to account for an exaggeration factor.

King Salmon

Sport fishery is comprised of three elements: the party boat troll fishery primarily in the ocean but occasionally in the Bay; ocean boat fishery, consisting of private and rental boats; and river angling in the Sacramento River.

Party boats offer the principal commercial service for fishing in the ocean. Private and rental boats operate up and down the coast, most of them operating out of ports north of Point Arena. Estimates of the catch for recent years are good because party boats are required to report their catches to the California Department of Fish and Game and the department has conducted creel surveys and sampling studies on private and rental boat king salmon fishery for a number of years. Data on the Sacramento River sport fishery are available only for 1962 through 1964.

The mean catch per angler day for the party boat fishery during the period 1958-1964 was 1.22 fish. For private and rental boats, the mean catch was about 0.6 fish per angler day. The mean catch in river fishery was considerably lower than either of the other two--0.24 fish per angler day.

In addition to general assumptions made for projection purposes, specific assumptions were made regarding salmon:

1. A decrease of 25 percent can be expected in the ocean salmon population off California by 2020. This assumption was made in view of the magnitude of proposed water developments in northern California and the projected rate of urban and industrial development. Mineral extraction and other uses or diversion from streams are expected to continue, all adversely affecting salmon habitat. Substantial programs of salmon enhancement were taken into account. Enhancement programs are expected in connection with proposed water developments through direct improvement of habitat and through expanded hatchery programs.

2. Present sport and commercial fisheries are operating efficiently and the present population is being exploited near capacity.

3. The mean annual catch per angler is expected to decrease. The mean annual catch per angler for the period 1955-1964 was 0.588 salmon. The same success is expected for 1970, but by 2020 this is expected to be reduced 25 percent to 0.441, the decrease

commencing with a 5 percent reduction by 1980, when the impact of water development and population growth is expected to take effect.

4. Because of the expected reduction in fish and angling quality, not more than 75 percent of the demand in angler days will be met in 2020.

5. Commercial fishing will continue but sport salmon fishing will become important enough, recreationally and economically, to bring about some curtailment of commercial fishery, if not by regulation then by sheer magnitude. By 2020, sport fishery is expected to account for about 40 percent of the total catch, as compared to the present 16 percent.

Estimates of demand in terms of angler effort and fish were prepared as an indication of the catch and effort that would occur if the resource were unlimited and if the existing trend were to continue. For purposes of determining demand, the mean effort for each method of angling for the period 1955-1964 was related to the mean of the population estimates of the 11 counties for 1950, 1960, and 1970 (median estimates).

The effort thus derived in terms of angler days per capita per year was as follows: party boat angling,0.01173; private and rental boat angling, 0.00664; river angling, 0.01771. Estimates of demand for salmon were based on mean annual success for the period 1955-1964 of 0.588 fish per angler.

Steelhead Trout

The steelhead trout fishery is concentrated in the upper Sacramento River. An additional 4,000 angler days are expended in streams tributary to San Francisco Bay, primarily in the Napa River system.

Steelhead trout depend on safe passage through the Bay or Delta in their migrations to and from the ocean. The entire steelhead resource and the angling effort expended for this species inside the Golden Gate are included in this study. The total resource in the Sacramento River system has been estimated at about 26,000 fish, the resources of other tributaries to San Francisco Bay being 3,000 fish. The mean effort in angler days for steelhead during the 1954-1965 period was 39,000 days per year.

Most of the effort for steelhead in that period originated in the Sacramento Valley. Only about 18 percent was expended by residents of the 11-county area.

For steelhead, the relationship between angling effort and the sale of angling licenses appears to be the most reliable basis for projecting future demand. Therefore, demand in angler days is assumed to increase in proportion to the statewide sale of angling licenses per capita rather than on the basis of population growth in the 11-county area. In terms of increase from 1960 as the base year, the factors by decade are:

1970	1.145
1980	1.271
1990	1.408
2000	1.534
2010	1.669
2020	1.796

It was assumed that the net resource in the Sacramento River system will be doubled by 2020 as a result of programs designed to enhance the steelhead. Efforts are expected to be made that would more than double the resource, but they will be paralleled by the attrition of habitat from urban, industrial, and agricultural growth and practices. In the case of tributaries to San Francisco Bay, the present trend of stream channelization, pollution, and general deterioration is expected to continue, with the result that the resource and effort related to it will be reduced by at least one half.

Striped Bass

The striped bass fishery is one of the most important in California and virtually the entire resource and angling effort is concentrated in San Francisco Bay and the Delta. It can be divided into three elements: party boat fishery, private and rental boat fishery, and shore and pier fishery.

Party boat fishery provides the most reliable records, since operators are required by law to maintain logs of their fishing trips, anglers, and catch. Creel censuses and angling surveys provide the best information on private and rental boat fishery. The estimate of effort by anglers fishing from shore or piers was synthesized from a variety of sources. Angling effort in the Delta, including private and rental boats, was obtained from the 1962-1963 Delta Recreation Survey by the Department of Parks and Recreation, which represents the most comprehensive survey of the area ever undertaken. Estimates of shore and pier effort in Central and South San Francisco Bay were based on instantaneous counts of anglers between July 1957 and February 1958.

Most of the present effort, and presumably future demand, for striped bass fishing springs from the 11 counties. Projection of demand was made on the basis of 1960 per capita use. This estimate, 0.335 days per capita, may seem high as a measure of immediate demand because of the unusually high striped bass effort in 1960, but it reflects the increasing rate shown by comparisons of per capita use from 1930 through 1960 and has been employed as the best immediate measure of future demand.

The first assumption in forecasting angling effort for striped bass is that the population of legal-sized bass will average at least 3 million fish through 2020. The second assumption is that by 2020 anglers will harvest about 40 percent of the available fish under a closely regulated fishery. On this basis, the total catch in 2020 is expected to approximate 1,200,000 fish, compared to the 1955-1964 mean estimate of 615,000.

Estimated mean annual success for the period 1955-1964 was 0.517 fish per angler day. Because individual success per unit of effort can be expected to decline as the total angling pressure increases, a minimum standard was established, the standard still providing quality angling in the year 2020 and a basis for direction of the management and regulation of the fishery. A graduated decrease to a minimum standard of 0.2 fish per angler day was established for 2020. This represents a decrease of 0.3 from the 1960 estimate of 0.5. Success in fish per angler day used to forecast use and catch beginning with 1960 is by decades as follows:

1960	0.500
1970	0.333
1980	0.311
1990	0.263
2000	0.247
2010	0.225
2020	0.222

Sturgeon

Sturgeon sport fishery is concentrated in San Pablo Bay, although an equal amount of effort is distributed from San Pablo Bay upstream past the city of Sacramento. Although sturgeon were once taken commercially, commercial fishing for sturgeon is now prohibited by law.

There are two species: white sturgeon and green sturgeon. White sturgeon, the larger and most important of the two, can exceed 10 feet and 1,000 pounds. Thus, they are considered a trophy fish. A total of about 6,000 angler days was spent on the party boats in 1965.

The maximum number of white sturgeon available for harvest every year is assumed to be about 2,500. It is also assumed that the minimum standard of quality necessary to sustain the fishery will be about 0.1 fish per angler day. Success in party boat fishery is now 0.321 fish per angler day. Total effort and catch of the other forms of the fishery are not known, but effort is assumed to be about the same as the party boat fishery and success is estimated at half that of the party boat fishery.

On this basis, it is estimated that the annual catch of 2,500 fish will be achieved by 1970 and, because of the additional angler effort, mean annual success per angler day will decline. Total use is estimated to increase from 7,500 angler days in 1970 to 25,000 angler days in 2020.

American Shad

American shad supported a limited commercial fishery in California until the fishery was prohibited by the legislature in 1957. The peak catch was almost 6 million pounds in 1917, but the annual catch usually fluctuated between 1 and 2 million pounds. The full potential of the resource was never exploited, due largely to the lack of consumer demand for the product in the form it was marketed.

The sport fishery is of recent origin, but it is gaining steadily in popularity. Fishing occurs principally in the larger tributaries to the Sacramento River, such as the American, Feather, and Yuba Rivers. American shad has proved a highly desirable sport fish, almost exclusively on the basis of its fighting qualities on light gear. Shad is expected to assume much more importance as a sport fish.

Shad represents a resource with a potential yield of about 2 million pounds, or 1 million fish per year. This resource is now practically untapped. Present use is estimated at about 100,000 angler days per year. There are no estimates of average angler success, but success is assumed to be 1.5 fish per angler day, making the present catch about 150,000 fish per year. Because the shad fishery is virtually untapped it offers great opportunity for expansion. Due to the relatively short duration of the run, however, and the limited amount of fishing area, the potential is not unlimited.

Demand is expected to increase in proportion to population growth in the lower Sacramento Valley rather than in the study area as a whole. Thus, total demand in angler days for 2020 is placed at 500,000 angler days, or five times the estimated present use. Mean annual success per angler is assumed to continue at 1.5 fish per angler day. Total catch, therefore, is expected to increase from the 1960 estimate of 150,000 to 750,000 in 2020.

Miscellaneous Bay Angling

Except for striped bass, angling in San Francisco Bay proper is for a heterogeneous mixture of rock fish, surf perch, flat fish, and cottids. Although the total effort for these species is substantial, individual treatment of them is not justified because the angling effort as a whole is not directed.

The fishery is distributed around the perimeters of both South and Central San Francisco Bays but is concentrated at points of access, particularly at Berkeley pier and the San Francisco Municipal pier. Angling is fairly heavy throughout the year, but the effort in July and August is about four times that of the winter months, when the effort is lowest.

Estimates of present use were available from several sources. The effort in 1960 was estimated at about 320,000 angler days. Almost all this effort can be attributed to residents of the 11 counties. Therefore, the estimation of future demand and use has been related to projected population estimates for these counties. Use for 1960 was estimated for Central and South San Francisco Bay regions respectively, at 0.052 and

0.045 days per capita. These factors were applied to the projected population estimates to develop future demand by decade.

Although a number of facilities have been built and others are proposed to improve angler access in the Bay and Delta, lack of access seriously impairs angling use throughout the area. Therefore, although data are not available to assess the degree of impairment accurately, for purposes of projecting future use, the estimates of demand for each decade have been reduced by 25 percent as an approximation of the effect of poor access.

Acceleration of the access program is expected, but the assumption seems to be warranted, since the program will continue to lag the need. In addition, because of the combination of competition and the possibility of a reduction of angling quality as a result of the heavy increase in use expected, a further reduction from the demand estimates was made. Estimates of demand were reduced by the cumulative amount of 2.5 percent per decade, causing use by 2020 to be estimated at only 65 percent of total demand.

Catfish

Catfish are caught only in the Delta. There was a commercial fishery for catfish until 1952, when, because of increasing competition with the sport fishery, it was abolished by the legislature. While the commercial fishery was operating, the catch generally ranged from 200,000 to 700,000 pounds a year. Catches exceeding 1 million pounds were recorded in 1908 and 1929.

Basic data on present use were obtained from the Delta Recreation Survey made by the Department of Parks and Recreation in 1962 and 1963. This study indicated that about 74 percent of the effort is made by shore anglers and 26 percent by boat anglers.

It is assumed that the sustained yield of catfish may be about 2.5 million fish per year. Although the sustained yield in the past may not have exceeded one million pounds, it is expected that anglers will fish the less productive and more remote areas that were either avoided or closed to the commercial fishery and that, under more competitive conditions, anglers will cover the entire fishing area more efficiently. In addition, some improvement in the resource can be expected in connection with the peripheral canal plan for transporting water around the Delta.

The present effort in the Delta devoted to catfish is estimated at 448,000 angler days a year, with an average catch of 2 fish per angler day. The ratio of catfish angler days developed by the 1962-1963 survey to the 1960 population estimate of the 11-county area was used to develop a measure of demand for future decades. The resulting estimate of 0.1021 days per capita was applied to the 11-county population projections for each decade. It was assumed that angler success will gradually decrease from 2 fish per angler day at present, to 1.5 fish by 2020. Estimates of angler success by decade are as follows:

1960	2.00
1970	1.83
1980	1.71
1990	1.64
2000	1.58
2010	1.53
2020	1.50

Largemouth Black Bass

Despite its deserved reputation as a food and game fish, the largemouth black bass fishery has not paralleled the apparent abundance of the resource in the Delta. It is believed that the resource could support much more effort than is evident. The species is widely scattered throughout the Delta, but its presence is limited to areas of essentially fresh water.

Present use is estimated at 11,000 angler days a year, as developed by the 1962-1963 Department of Parks and Recreation survey. Angler success was estimated at 0.5 fish per angler day. Therefore, the estimate of total catch is about 5,500 fish for the survey period.

Most present and future effort is expected to come from the 11-county area residents, with only 7 percent from other parts of the state. The basis for projecting future demand, therefore, as in the case of catfish, was the ratio of use as established in the Department of Parks and Recreation survey to the 1960 estimate of the population in the 11-county area. The estimate, 0.0025 angler days per capita, was applied to the population projections for the 11 counties to develop estimates of demand by decade.

Unidentified Delta Angling

The Department of Parks and Recreation 1962-1963 survey of recreation use in the Delta does not identify the type of angling in some cases. In other cases, where identification is made, the species are too small a segment of the overall angling effort to be classified separately. These categories have been combined here.

The total estimate of unidentified angling efforts was 79,000 angler days for the 1962-1963 study period. A large part of this effort is undoubtedly directed toward striped bass and catfish, with the result that this effort is believed to stem from the 11-county area. The amount of future effort, therefore, was estimated on the basis of the ratio of such effort to the 11-county population estimate for 1960. The estimate of 0.018 angler day per capita was applied to population estimates of the 11-county area for each decade to obtain estimates of the total effort by decade.

XII COMMERCIAL FISHING

San Francisco was the chief commercial fishing port in California from 1850 until shortly after 1900, and until almost 1900, much of the resource was harvested directly from the Bay and its upstream tributaries. Commercial fishing in the Bay and Delta is almost entirely gone now, however.

The change has occurred over 50 years as a result of the gradual curtailment of commercial operations by regulation, attrition of resources, economic factors, and legislative prohibition designed either to alleviate conflicts with sport fisheries or to protect the resources.

Flatfish, bottomfish, and crab fishing were abandoned in the Bay around 1900. The shrimp fishery was severely restricted in 1911. Sturgeon were given complete protection in 1917. Commercial fishing for striped bass was abolished in 1935, as was catfish in 1953, and shad and salmon in 1957. The clam fishery collapsed after 1940. Limited commercial landings of shrimp, herring, white bait, anchovies, and smelt continued into the 1950s.

Commercial fishing in the Bay is no longer economically feasible, and with the possible exception of bay shrimp and the anchovie and herring bait fishery, this situation is expected to continue. Resources in the Bay cannot presently sustain a commercial fishery.

The Bay seems to have immense potential for shell-fish culture (oysters and clams) under modern cultural practices. Water quality and public health restrictions, however, rule out such consideration at present.

The only commercial species of any magnitude dependent on the Bay and Delta is king salmon. They are caught in the ocean but depend on the Bay and Delta for safe passage to and from the spawning grounds. The average catch for 1955-1964 was about 5.8 million pounds a year. Because the demand for salmon exceeds the actual supply of fish by a substantial margin, the catch is essentially a function of the availability of fish. For purposes of this report, it was assumed that the mean catch for 1955-1964 was equivalent to the annual per capita demand of consumers in the 11-county area.

Most of the commercial salmon catch is sold fresh, frozen, or mild-cured. The bulk of it is believed to be consumed in the 11-county area, although some of it is shipped out of state, about 20 percent being mild-cured for sale in New York. The estimated demand for salmon, based on these assumptions, is 1.275 pounds per capita. Projection of future demand involves the application of this per capita estimate to population projections.

Preceding page blank

As already pointed out in the discussion of sport fishing, a decrease of 25 percent in the ocean salmon population off California is projected by 2020. It is also assumed that the sport fishery will account for about 40 percent of the total catch, as compared to the present 16 percent. Therefore, the commercial catch is projected to decline continually from 1970 through 2020, from 5.4 million pounds a year to 3 million pounds.

XIII WATERFOWL HUNTING

San Francisco Bay and the Delta provide needed habitat for wintering waterfowl and year-round habitat and breeding area for vast numbers of shore and marsh birds. Open waters of the bays provide feeding and roosting areas for canvasback, scaup, and scoters, especially. The marshes surrounding the Bay are equally important in the overall waterfowl picture.

From 1955 to 1964, the average number of hunter days was about 140,000, with a success rate of 2.12 birds per hunter day. Almost all the use was by residents of the 11-county area. The ratio of hunter use to the 1960 population estimate was used to develop per capita use for estimating future demand. The resulting estimate of 0.0319 hunter days per capita was applied to projected population estimates to obtain total demand by decade. Estimates of demand for each area were obtained by apportioning the total demand among the regions on the basis of the 1955-1964 data.

Because more than half the tideland can be developed, and because further industrial and commerce associated navigational development is expected, it is estimated that at least 25 percent of the present waterfowl resource of the study area will not be available to hunters by 2020. Reduced public access for waterfowl hunting and the decreased availability of the resource are expected to work against hunting and reduce the kill another 25 percent. Total harvest in 2020 is, therefore, assumed to be about 50 percent that of the present time.

For estimating future hunting effort, a minimum standard of success of one bird per hunter day by 2020 is assumed. In the interim, regulations will probably serve to maintain success at the highest possible level, but hunter success will decrease with both reduction in the availability or outright loss of the resource and increased use expected in the next few decades.

In considering future hunting efforts, it is noted that annual sales of the federal migratory bird stamps, required to hunt waterfowl, have not kept pace with sales of hunting licenses, indicating that waterfowl hunters are increasing at a slower rate than hunters in general.

The waterfowl kill in 2020 is estimated at 155,000 birds per year. Hunter success is expected to diminish from the 1955-1964 level of 2.12 per hunter day to 1 bird per hunter day by 2020. Estimates of mean annual success in birds per hunter day used in forecasting future effort are:

1970	1.95
1980	1.76
1990	1.57
2000	1.38
2010	1.19
2020	1.00

Despite the reduction in waterfowl, the total hunter effort is expected to remain constant through 2020. This stems from a potential fourfold demand for this type of recreation that might be expected from population growth.

Estimates of effort and kill for each region of the study area were obtained by apportioning the total effort and kill to each region on the basis of 1955-1964 data (Table 68).

PART 3

EVALUATION OF ECONOMIC BENEFITS

XIV METHOD OF COMPUTATION

Procedure

Economic benefits of recreation in the study area were computed by a two-step procedure. The first was to multiply estimated use in participation days by a unit economic benefit in dollars per participation day. The second was to discount future benefits to the present.

Selected Method and Justification

The method of computing economic benefits of recreation adopted by the Ad Hoc Water Resources Council was selected because although there was found to be no universal agreement on method, the selected one is easily understood and federal agencies involved in water resources have reached a working agreement on it.

The method is described in Supplement 1 to Senate Document 97, "Evaluation Standards for Primary Outdoor Recreation Benefits," June 4, 1964. This document, prepared for use by federal agencies in evaluating recreation benefits on water resource projects, defines two types of recreational activities, a range of unit economic benefits being prescribed for each.

The first consists of "general project recreation activities," which include most outdoor recreation and generally require development and maintenance of convenient access and adequate facilities. This type includes, but is not limited to, most warm water fishing, swimming, picnicking, hiking, sightseeing, most small game hunting, nature studies (except nature photography), tent and trailer camping, marine pier and party boat fishing, water skiing, scuba diving, motor boating, sailing, and canoeing in placid waters.

The second concerns "specialized project recreation activities." These are activities for which opportunities are generally limited, the intensity of use is low, and which may involve large expenses for the user. This category includes, but is not limited to, coldwater fishing for resident and migratory species, upland bird and waterfowl hunting, specialized nature photography, big game hunting, wilderness pack trips, white water boating and canoeing, and large range cruises in areas of outstanding scenery.

The unit economic benefits set forth in the Senate Document Supplement are intended to measure the amount that users would be willing to

Preceding page blank

pay if such payments were required to avail themselves of the recreation resources. Net benefits for general recreation activities range from $0.50 to $1.50 per participation day. Specialized activities range from $2 to $6 per participation day.

Within these ranges, unit economic benefits are to be selected that adequately reflect the particular situation for each recreational activity. The situation can include such factors as the adequacy of facilities and the quality of the recreational experience in the area for that activity. According to the supplement, all recreational activities in the San Francisco Bay and Delta area, except hunting and certain classes of fishing, are to be considered general recreational activities.

A value was reached by judgment for the probable economic benefit of each activity, both general and special, for each decade from 1960 to 2020. The adopted values are given in Table 69.

Three sets of estimates were made in evaluating recreation benefits in the Bay and Delta area to appraise the sensitivity of the calculated recreation benefits.

In the first set, recreation use estimates computed on the basis of median population projections were combined with upper and lower unit economic benefits established in the supplement to compute total recreation benefits.

For example, the total projected sunbathing and swimming use in the year 2000 is 15.74 million days a year. This is classed as a general recreation activity to which the range of $0.50 to $1.50 per participation day applies. Therefore, the range of recreation benefits for this category of use would equal 15.74 million days times $0.50 per participation day for the lower limit and 15.74 million days times $1.50 for the upper limit.

Likewise, for salmon fishing, a specialized activity, the amount of participation in 2000 is 0.37 million days per year. This is multiplied by $2 per participation day for the lower limit of recreation benefits and $6 per participation day for the upper limit.

In both cases, the upper limit is three times the lower limit. Therefore, if an estimate of the high recreation benefits is available, the lower limit can be obtained by dividing by three. Estimates are made for both total use and for each of the five regions by activity.

The second set of estimates was a medium estimate based on median population projections and a best judgment estimate of the unit economic benefit of each recreational activity within the specified ranges. In other words, instead of computing sunbathing and swimming at either $0.50 or $1.50 per participation day, an estimate was made within that range, as shown in Table 69. These estimated unit economic benefits were multiplied by the estimates of recreation use in participation days to obtain the total medium recreation benefits.

Table 69

MEDIUM UNIT VALUES
(Dollars per Participation Day)

Activity	1960	1965	1970	1980	1990	2000	2010	2020
Sunbathing and swimming	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Sightseeing	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Boating	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Water skiing	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Picnicking	1.25	1.25	1.25	1.30	1.35	1.40	1.45	1.50
Nature walking	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hunting	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50
Camping	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Hiking	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Striped bass angling	3.50	3.50	3.50	3.50	3.75	4.00	4.25	4.50
Catfish angling	1.00	1.00	1.00	1.00	1.25	1.25	1.50	1.50
Miscellaneous bay angling	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ocean and bay salmon angling	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
River salmon angling	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50
Unidentified delta angling	2.50	2.50	2.50	2.50	2.75	2.75	3.00	3.00
American shad angling	2.50	2.50	2.50	2.50	2.75	2.75	3.00	3.00
Steelhead angling	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Largemouth black bass angling	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Sturgeon angling	3.50	3.75	4.00	4.50	5.00	5.50	6.00	6.00

The third set of estimates was made, assuming high and low population projections combined with high and low unit economic benefits, respectively. The high and low population projections were estimated from Appendix A. Figures in Table 95 were increased 60 percent and the median estimates of recreation use were adjusted by that factor to obtain high and low estimates of recreation use by decade, activity, and region. The high estimates of recreation use were then multiplied by the high unit economic benefit for each recreational activity. Likewise, the low estimates of recreation use were multiplied by the low unit economic benefits.

Results of these computations are shown in Figure 8, which shows the total recreation benefits for all population projections. Figures 9 through 13 show the breakdown by region. High, medium, and low estimates are included.

Benefits from commercial fishing were based on unit economic benefits of 35 cents a pound. This is equal to the primary benefits from commercial fishing and equals 62 percent of the 1964 sale price of the commercial catch--62 percent of the off-vessel sale price. This percentage has been used by the Bureau of Sport Fisheries and Wildlife of the U.S. Department of Interior for calculating benefits from commercial fishing and was adopted for use in this report.

Calculation of Discounted Future Benefits

Recreational benefits for the San Francisco Bay and Delta area and each of the five regions into which the area was divided were discounted, using appropriate compound interest methods to 1970. The period of discounting was from 1970 to 2020. Each segment of the projected recreation benefit curves was considered to be composed of two components: a uniform annual series and a gradient series. The gradient series was converted to an equivalent uniform series at the appropriate interest rate. Then the total equivalent uniform series was converted to present worth in 1970. The total present worth in 1970 was converted to a uniform annual series over the period 1970 to 2020. This is the measure of net annual recreation benefits.

The interest rates used in these calculations were 3, 4, and 5 percent. An interpolation was made for the current rate used by federal agencies, 3-1/8 percent. The range of interest rates was used to allow estimation of the sensitivity of annual benefits to the interest rate used and to allow the figures to be used at some future time when the discount rate is something other than 3-1/8 percent.

FIGURE 8

ECONOMIC BENEFITS OF RECREATION ACTIVITIES
San Francisco Bay and Delta

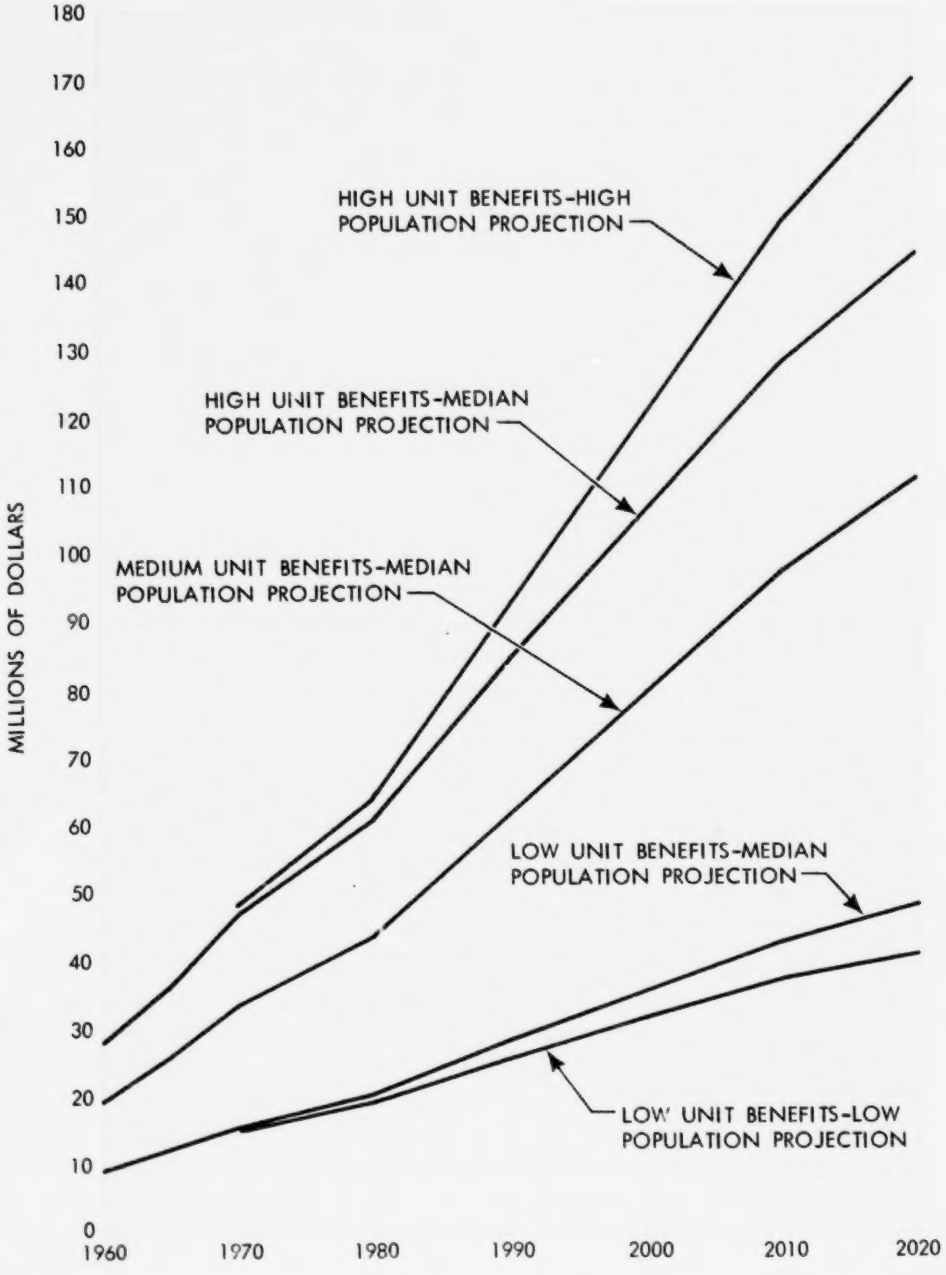


FIGURE 9

ECONOMIC BENEFITS OF RECREATION ACTIVITIES

South San Francisco Bay

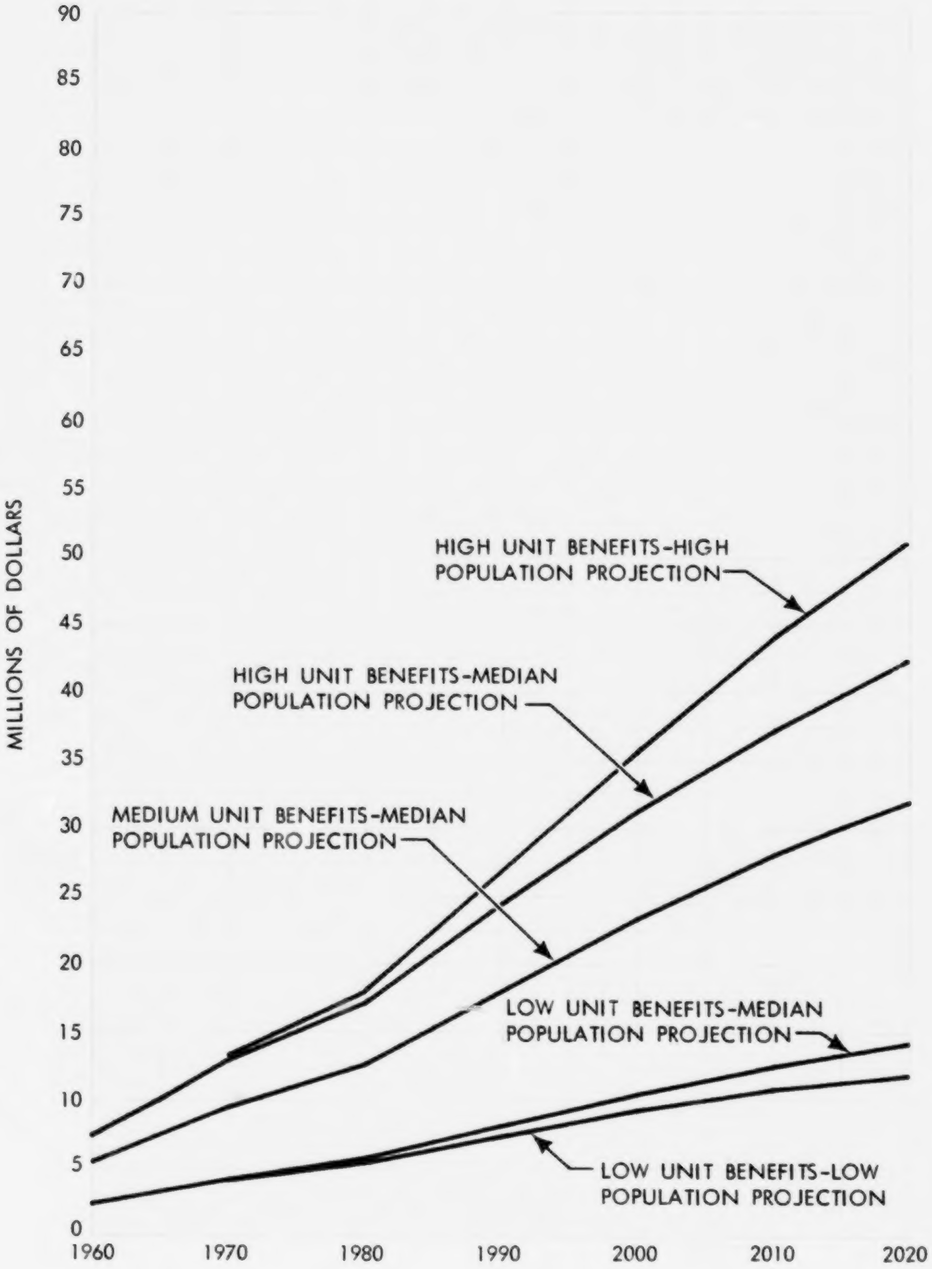


FIGURE 10

ECONOMIC BENEFITS OF RECREATION ACTIVITIES
Central San Francisco Bay

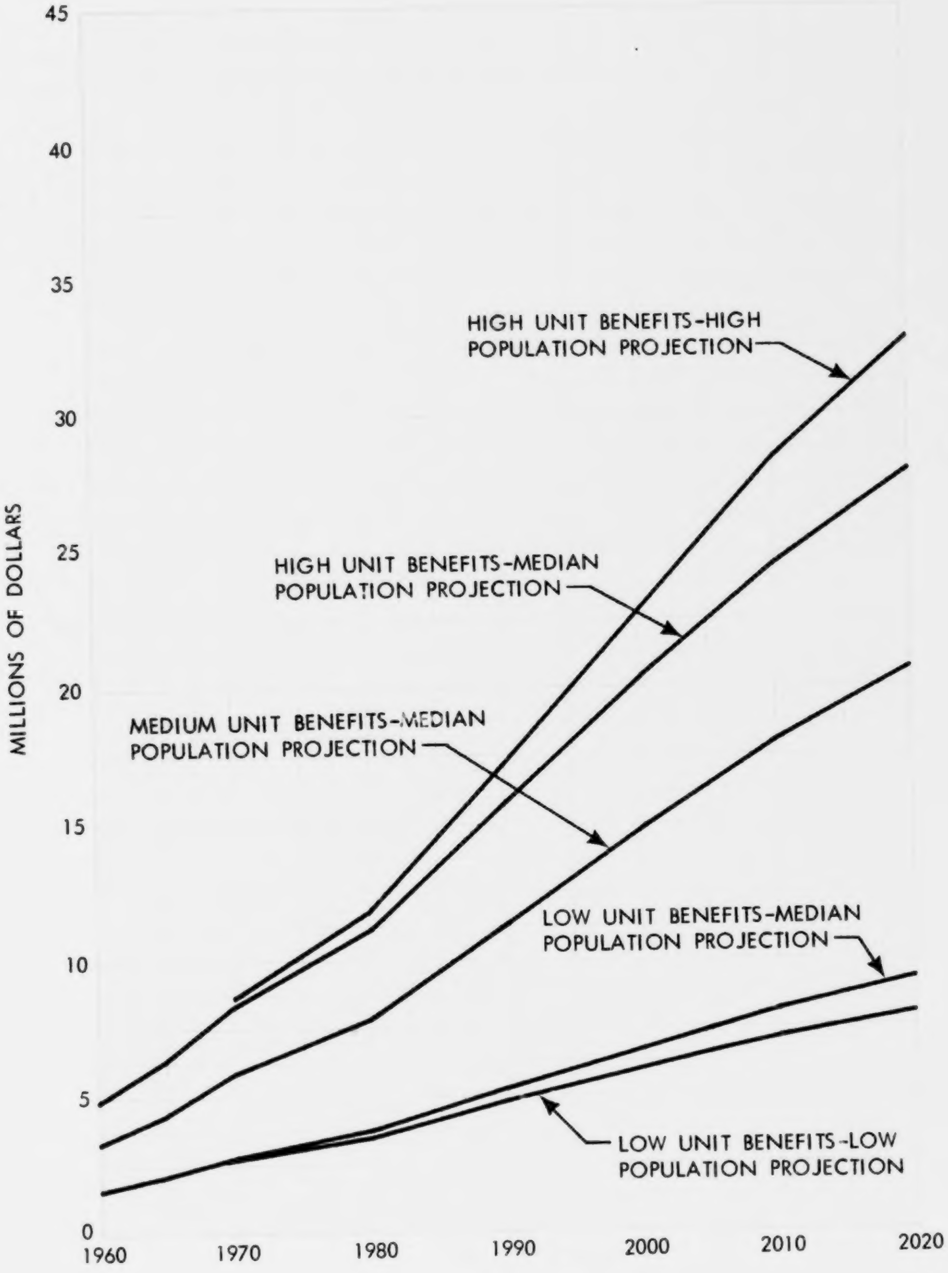


FIGURE 11

ECONOMIC BENEFITS OF RECREATION ACTIVITIES
San Pablo Bay

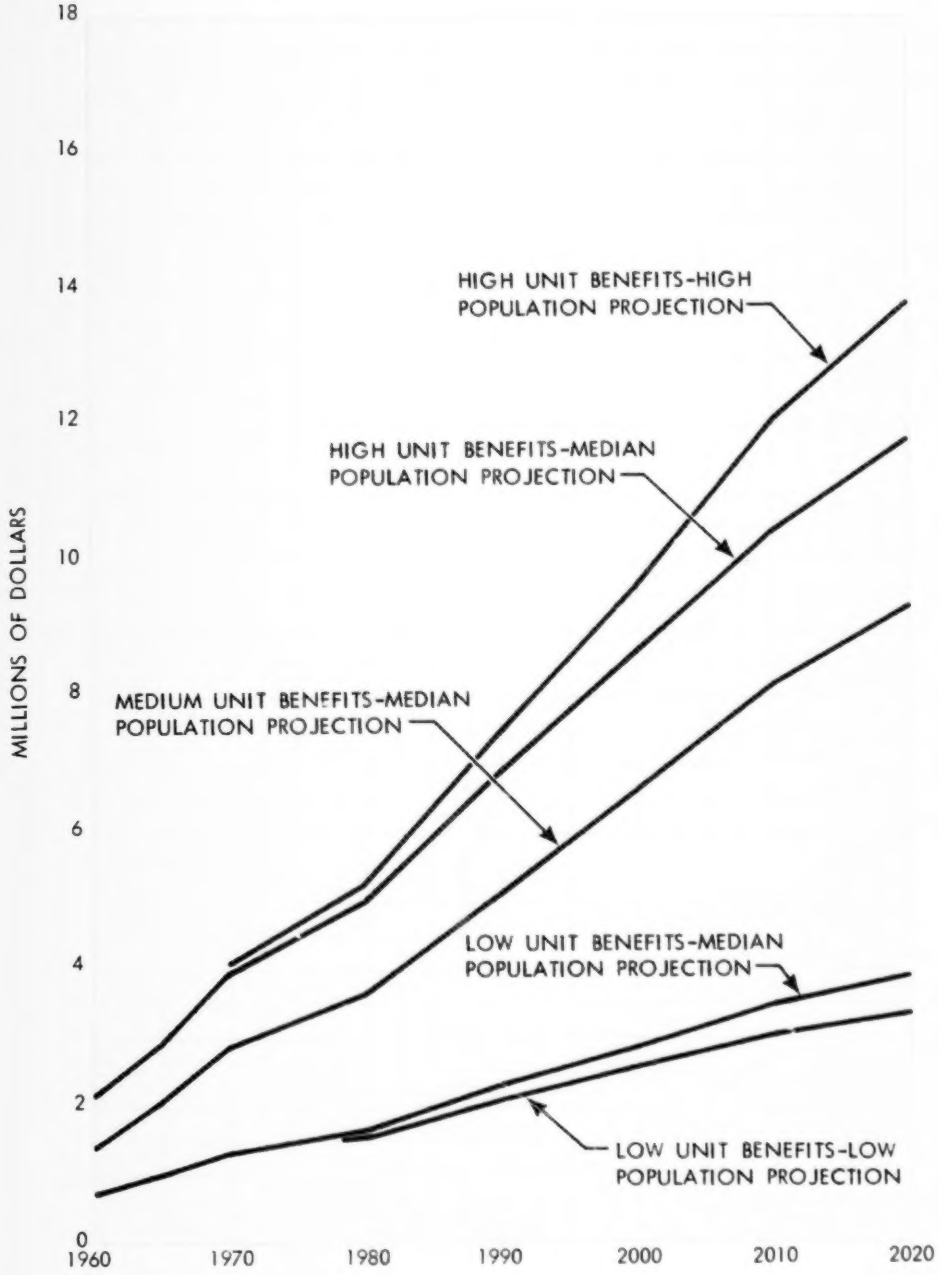


FIGURE 12

ECONOMIC BENEFITS OF RECREATION ACTIVITIES
Suisun Bay

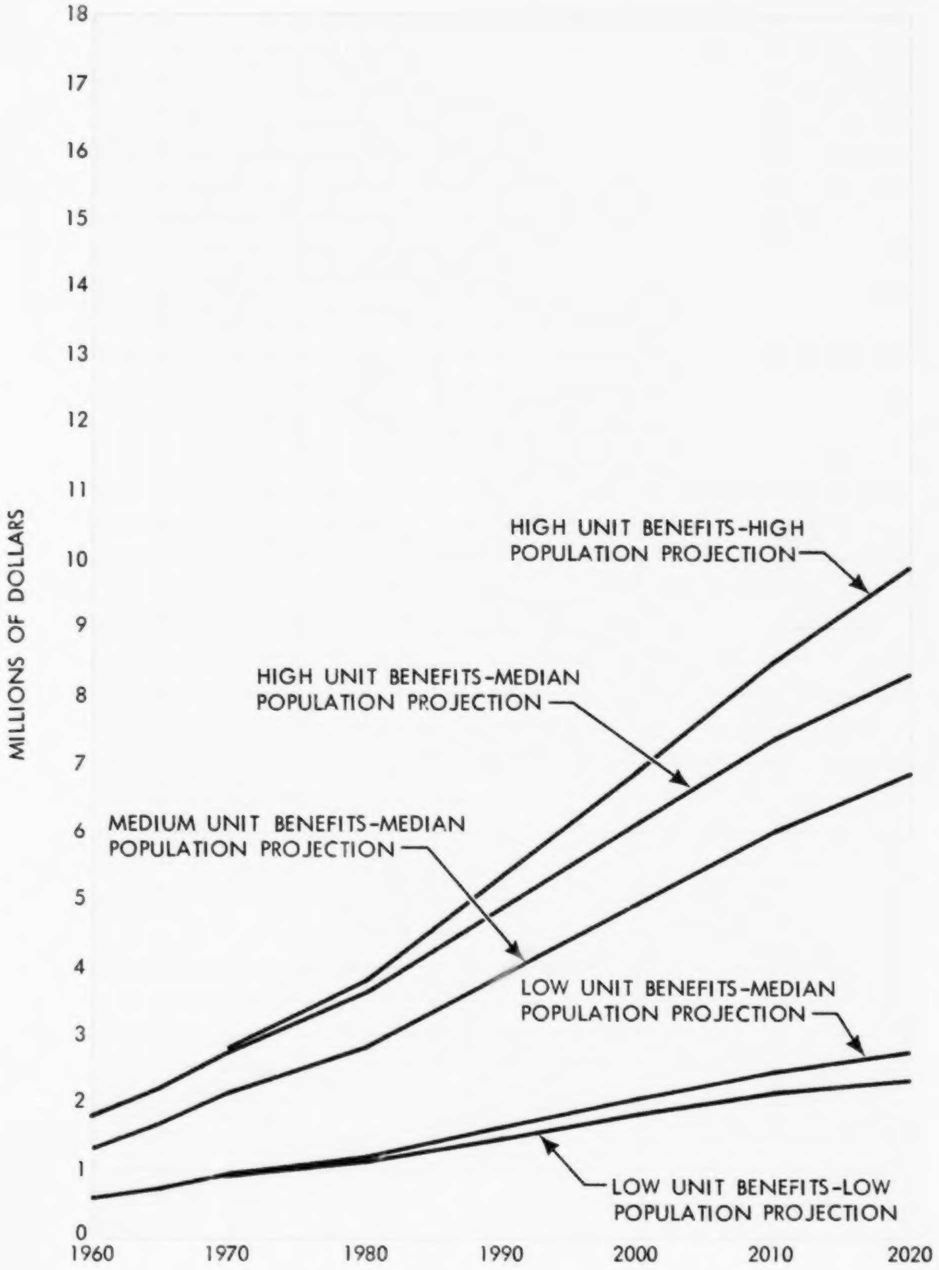
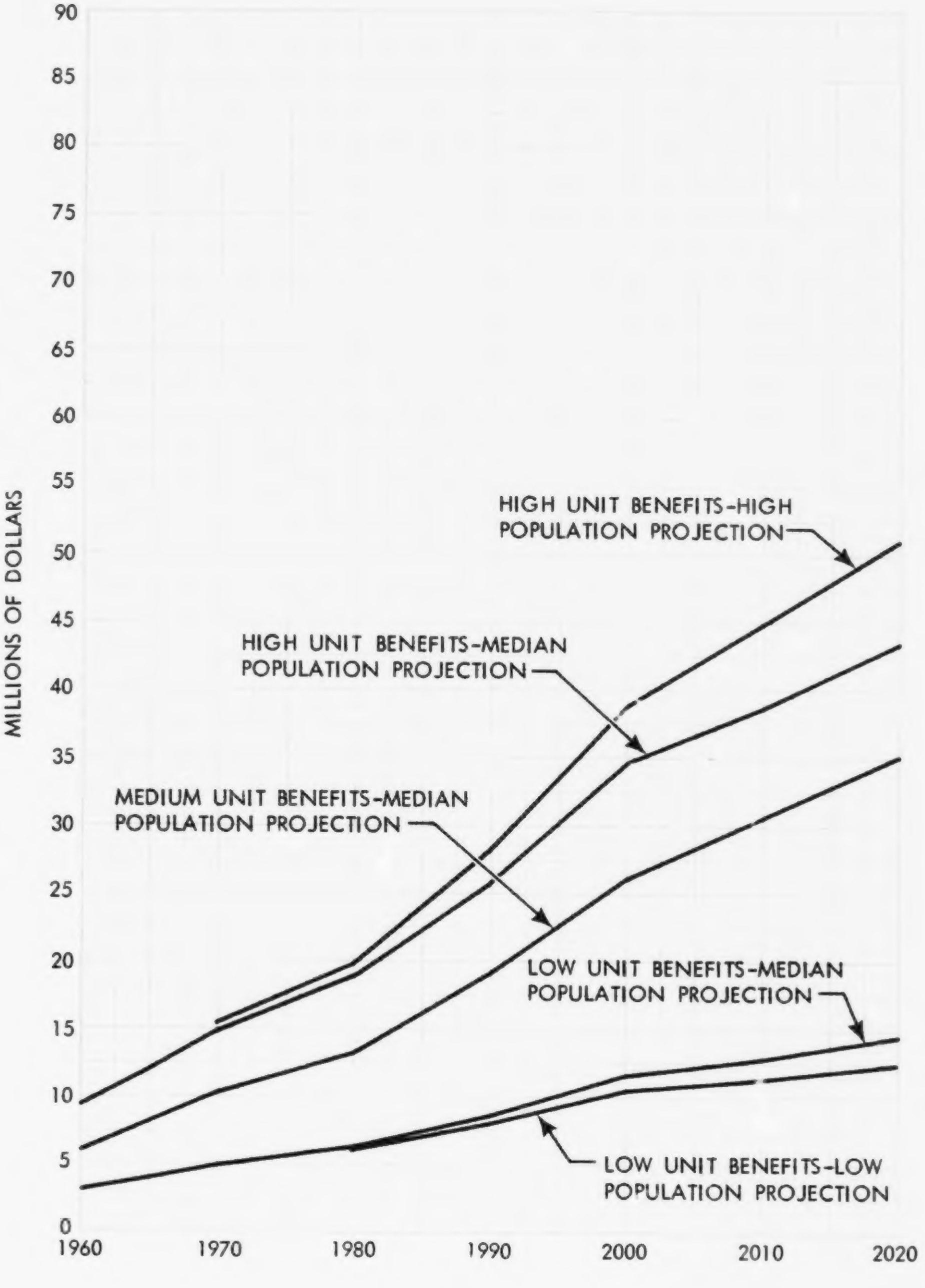


FIGURE 13

ECONOMIC BENEFITS OF RECREATION ACTIVITIES
Delta



XV SUMMARY OF BENEFITS

Annual recreation benefits are summarized in Table 70. Breakdowns are given in this table for each region in the San Francisco Bay and Delta area and for four separate interest rates: 3, 3-1/8, 4, and 5 percent. Separate tabulations are given for each of five conditions:

1. Medium unit recreation values, and recreation use estimates based on median population projections
2. High unit recreation values, and recreation use estimates based on high population projections
3. High unit recreation values, and recreation use estimates based on median population projections
4. Low unit recreation values, and recreation use estimates based on median population projections
5. Low unit recreation values, and recreation use estimates based on low population projections.

Tables 71 to 94 give detailed breakdowns of the recreation benefits for each region and for the San Francisco Bay and Delta area as a whole.

The most probable total annual recreation benefits in the Bay and Delta area are estimated to be $59.60 million, distributed as follows: South San Francisco Bay, $17.30 million; Central San Francisco Bay, $10.99 million; San Pablo Bay, $5.04 million; Suisun Bay, $3.76 million; Delta, $18.81 million; and others, $3.70 million. These estimates assume median population projections and medium unit recreation values, the discount rate being 3-1/8 percent.

Net benefits from commercial fishing are estimated to be $1.38 million per year based on the following tabulation of the commercial catch for 1970-2020:

	1970	1980	1990	2000	2010	2020
Catch (1000 pounds)	5410	4950	4280	3740	3270	2980
Economic benefits (millions of dollars)	$1.89	1.63	1.50	1.31	1.14	1.04

Figures 14 and 15 show the projected benefits from commercial fishing for the period 1960 to 2020.

Table 70

SUMMARY OF ANNUAL ECONOMIC BENEFITS FROM RECREATION
(Millions of Dollars)

	Interest Rate (percent)			
	3%	3-1/8%	4%	5%
Medium unit values, median population projection				
SSF*	$17.40	$17.30	$16.60	$15.80
CSF*	11.06	10.99	10.51	10.02
S. Pablo*	5.07	5.04	4.82	4.61
Suisun*	3.78	3.76	3.61	3.45
Delta*	18.93	18.81	17.99	17.14
Total†	$60.00	$59.62	$57.00	$54.30
High unit values, high population projection				
SSF	26.20	26.02	24.80	23.50
CSF	16.80	16.78	15.95	15.18
S. Pablo	7.38	7.33	7.01	6.69
Suisun	5.24	5.21	4.98	4.74
Delta	28.18	28.01	26.81	25.56
Total	$89.80	$89.26	$85.50	$81.10
High unit values, median population projection				
SSF	23.50	23.36	22.40	21.40
CSF	15.31	15.22	14.58	13.92
S. Pablo	6.70	6.66	6.41	6.14
Suisun	4.71	4.69	4.52	4.33
Delta	25.58	25.45	24.51	23.49
Total	$81.90	$81.39	$77.80	$74.20
Low unit values, median population projection				
SSF	7.87	7.82	7.49	7.15
CSF	5.11	5.08	4.86	4.64
S. Pablo	2.25	2.24	2.16	2.06
Suisun	1.57	1.56	1.50	1.44
Delta	8.55	8.50	8.18	7.84
Total	$27.10	$26.95	$25.90	$24.70

(continued)

Table 70 (concluded)

	Interest Rate (percent)			
	3%	3-1/8%	4%	5%
Low unit values, low population projection				
SSF	7.06	7.02	6.76	6.49
CSF	4.63	4.59	4.32	4.25
S. Pablo	2.08	2.07	2.00	1.92
Suisun	1.45	1.44	1.40	1.34
Delta	7.88	7.84	7.58	7.30
Total	$24.70	$24.55	$23.50	$22.70

---

* SSF = South San Francisco Bay
CSF = Central San Francisco Bay
S. Pablo = San Pablo Bay
Suisun = Suisun Bay
Delta = Delta

† Includes benefits from recreational activities which occur outside the five regions.

Table 71

ECONOMIC BENEFITS OF RECREATION ACTIVITIES
SAN FRANCISCO BAY AND DELTA AREA
MEDIUM UNIT VALUES, MEDIAN POPULATION PROJECTIONS
(Millions of Dollars per Year)

Activity	1960	1965	1970	1980	1990	2000	2010	2020
Sunbathing and swimming	$ 3.74	$ 5.01	$ 6.59	$ 8.63	$12.34	$15.74	$18.67	$ 21.08
Sightseeing	3.45	4.38	5.48	7.62	11.00	14.63	17.80	20.77
Boating	2.85	3.62	4.31	5.89	8.31	11.11	13.63	15.55
Water skiing	0.75	2.42	4.37	5.87	8.51	11.03	13.22	14.93
Picnicking	0.55	0.75	0.96	1.25	1.77	2.28	2.81	3.26
Nature walking	0.26	0.30	0.36	0.48	0.68	0.88	1.13	1.37
Hunting	0.54	0.54	0.63	0.63	0.63	0.63	0.63	0.63
Camping	0.08	0.15	0.26	0.32	0.42	0.53	0.62	0.69
Hiking	0.01	0.02	0.03	0.04	0.06	0.08	0.09	0.10
Fishing								
Striped bass	5.22	6.30	7.49	9.10	12.94	16.24	20.78	24.30
Catfish	0.45	0.53	0.61	0.73	1.25	1.55	2.24	2.48
Miscellaneous bay angling	0.32	0.32	0.33	0.39	0.52	0.62	0.72	0.76
Ocean and bay salmon	0.24	0.48	0.66	0.72	0.96	1.14	1.32	1.32
River salmon	0.36	0.36	0.50	0.54	0.72	0.81	0.95	0.99
Unidentified delta angling	0.20	0.23	0.28	0.33	0.50	0.61	0.78	0.87
American shad	0.13	0.20	0.30	0.50	0.77	0.96	1.26	1.50
Steelhead trout	0.20	0.20	0.25	0.30	0.30	0.30	0.35	0.35
Largemouth black bass	0.02	0.02	0.03	0.03	0.03	0.05	0.06	0.06
Sturgeon	0.00	0.04	0.04	0.05	0.05	0.06	.12	.18
Total	$19.37	$25.87	$33.48	$43.42	$61.76	$79.25	$97.18	$111.19

Table 72

ECONOMIC BENEFITS OF RECREATION ACTIVITIES
SAN FRANCISCO BAY AND DELTA AREA
HIGH UNIT VALUES,* MEDIAN POPULATION PROJECTIONS
(Millions of Dollars per Year)

Activity	1960	1965	1970	1980	1990	2000	2010	2020
Sunbathing and swimming	$ 5.61	$ 7.52	$ 9.89	$12.95	$18.51	$ 23.61	$ 28.01	$ 31.62
Sightseeing	5.18	6.57	8.22	11.43	16.50	21.95	26.70	31.16
Boating	2.86	3.62	4.32	5.89	8.33	11.06	13.70	15.57
Water skiing	0.75	2.42	4.37	5.87	8.51	11.03	13.22	14.93
Picnicking	0.66	0.90	1.16	1.44	1.97	2.45	2.91	3.26
Nature walking	0.39	0.45	0.54	0.72	1.02	1.32	1.70	2.06
Hunting	0.72	0.72	0.84	0.84	0.84	0.84	0.84	0.84
Camping	0.08	0.15	0.26	0.32	0.42	0.53	0.62	0.69
Hiking	0.02	0.03	0.05	0.06	0.09	0.12	0.14	0.15
Fishing								
Striped bass	8.94	10.80	12.84	15.60	20.70	24.36	29.34	32.40
Catfish	0.68	0.80	0.92	1.10	1.50	1.86	2.24	2.48
Miscellaneous bay angling	0.48	0.48	0.50	0.59	0.78	0.93	1.08	1.14
Ocean and bay salmon	0.24	0.48	0.66	0.72	0.96	1.14	1.32	1.32
River salmon	0.48	0.48	0.66	0.72	0.96	1.08	1.26	1.32
Unidentified delta angling	0.48	0.54	0.66	0.78	1.08	1.32	1.56	1.74
American shad	0.30	0.48	0.72	1.20	1.68	2.10	2.52	3.00
Steelhead trout	0.24	0.24	0.30	0.36	0.36	0.36	0.42	0.42
Largemouth black bass	0.02	0.02	0.03	0.03	0.03	0.05	0.06	0.06
Sturgeon	0.00	0.06	0.06	0.06	0.06	0.06	0.12	0.18
Total	$28.13	$36.76	$47.00	$60.68	$84.30	$106.17	$127.76	$144.34

---

* Economic benefits for low unit values are one-third those in this table.

Table 73

ECONOMIC BENEFITS OF RECREATION ACTIVITIES
SAN FRANCISCO BAY AND DELTA AREA
HIGH UNIT VALUES, HIGH POPULATION PROJECTIONS
(Millions of Dollars per Year)

Activity	1970	1980	1990	2000	2010	2020
Sunbathing and swimming	$10.22	$13.67	$20.43	$ 27.05	$ 33.21	$ 37.98
Sightseeing	8.46	11.96	17.96	24.54	30.77	36.24
Boating	4.50	6.26	9.23	12.68	16.16	19.41
Water skiing	4.55	6.23	9.42	12.48	15.60	17.87
Picnicking	1.20	1.53	2.19	2.84	3.50	3.99
Nature walking	0.56	0.77	1.14	1.53	2.06	2.52
Hunting	0.84	0.90	0.90	0.96	0.96	1.02
Camping	0.23	0.32	0.45	0.59	0.75	0.90
Hiking	0.05	0.06	0.11	0.14	0.17	0.18
Fishing						
Striped bass	13.14	16.32	22.32	26.64	33.18	36.78
Catfish	0.93	1.14	1.62	2.04	2.54	2.81
Miscellaneous bay angling	0.51	0.62	0.84	1.02	1.22	1.31
Ocean and bay salmon	0.66	0.78	1.02	1.26	1.50	1.50
River salmon	0.66	0.78	1.02	1.20	1.44	1.50
Unidentified delta angling	0.66	0.84	1.14	1.44	1.74	1.98
American shad	0.72	1.26	1.80	2.28	2.88	3.42
Steelhead trout	0.30	0.36	0.36	0.42	0.48	0.48
Largemouth black bass	0.03	0.03	0.03	0.05	0.08	0.08
Sturgeon	0.06	0.06	0.06	0.06	0.18	0.18
Total	$48.28	$63.89	$92.04	$119.22	$148.42	$170.15

Table 74

ECONOMIC BENEFITS OF RECREATION ACTIVITIES
SAN FRANCISCO BAY AND DELTA AREA
LOW UNIT VALUES, LOW POPULATION PROJECTIONS
(Millions of Dollars per Year)

Activity	1970	1980	1990	2000	2010	2020
Sunbathing and swimming	$ 3.19	$ 4.08	$ 5.56	$ 6.88	$ 7.99	$ 8.75
Sightseeing	2.66	3.64	5.05	6.53	7.75	8.95
Boating	1.42	1.88	2.53	3.23	3.85	4.09
Water skiing	1.40	1.84	2.57	3.20	3.77	4.12
Picnicking	0.38	0.46	0.59	0.71	0.80	0.88
Nature walking	0.18	0.23	0.31	0.39	0.47	0.56
Hunting	0.28	0.26	0.26	0.24	0.26	0.24
Camping	0.07	0.09	0.12	0.15	0.18	0.21
Hiking	0.02	0.02	0.03	0.04	0.04	0.04
Fishing						
Striped bass	4.18	5.00	6.40	7.44	8.76	9.52
Catfish	0.30	0.35	0.47	0.57	0.67	0.73
Miscellaneous bay angling	0.16	0.19	0.24	0.29	0.33	0.34
Ocean and bay salmon	0.22	0.24	0.30	0.34	0.40	0.40
River salmon	0.22	0.24	0.30	0.34	0.38	0.38
Unidentified delta angling	0.22	0.26	0.34	0.40	0.48	0.52
American shad	0.24	0.38	0.52	0.64	0.76	0.88
Steelhead trout	0.10	0.12	0.12	0.12	0.12	0.12
Largemouth black bass	0.01	0.01	0.01	0.02	0.02	0.02
Sturgeon	0.02	0.02	0.02	0.02	0.02	0.02
Total	$15.27	$19.31	$25.74	$31.55	$37.05	$40.77

Table 75

ECONOMIC BENEFITS OF RECREATION ACTIVITIES
SOUTH SAN FRANCISCO BAY
MEDIUM UNIT VALUES, MEDIAN POPULATION PROJECTIONS
(Millions of Dollars per Year)

Activity	1960	1965	1970	1980	1990	2000	2010	2020
Sunbathing and swimming	$2.74	$3.68	$4.84	$ 6.33	$ 9.06	$11.55	$13.70	$15.47
Sightseeing	0.58	0.75	0.92	1.27	1.84	2.44	2.97	3.47
Boating	1.15	1.43	1.73	2.35	3.31	4.39	5.45	6.20
Water skiing	0.18	0.60	1.08	1.44	2.10	2.72	3.26	3.68
Picnicking	0.11	0.16	0.20	0.26	0.36	0.48	0.58	0.68
Nature walking	0.11	0.13	0.15	0.21	0.29	0.38	0.48	0.59
Hunting	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.14
Camping	--	--	--	--	--	--	--	--
Hiking	--	--	--	--	--	--	--	--
Fishing								
Striped bass	0.32	0.35	0.42	0.53	0.75	0.96	1.19	1.40
Catfish	--	--	--	--	--	--	--	--
Miscellaneous bay angling	0.15	0.15	0.15	0.18	0.24	0.29	0.33	0.35
Ocean and bay salmon	--	--	--	--	--	--	--	--
River salmon	--	--	--	--	--	--	--	--
Unidentified delta angling	--	--	--	--	--	--	--	--
American shad	--	--	--	--	--	--	--	--
Steelhead trout	--	--	--	--	--	--	--	--
Largemouth black bass	--	--	--	--	--	--	--	--
Sturgeon	--	--	--	--	--	--	--	--
Total	$5.43	$7.34	$9.58	$12.66	$18.04	$23.30	$28.05	$31.98

Table 76

ECONOMIC BENEFITS OF RECREATION ACTIVITIES
SOUTH SAN FRANCISCO BAY
HIGH UNIT VALUES,* MEDIAN POPULATION PROJECTIONS
(Millions of Dollars per Year)

Activity	1960	1965	1970	1980	1990	2000	2010	2020
Sunbathing and swimming	$4.11	$ 5.52	$ 7.26	$ 9.50	$13.59	$17.33	$20.55	$23.21
Sightseeing	0.87	1.13	1.38	1.91	2.76	3.66	4.46	5.21
Boating	1.15	1.43	1.73	2.35	3.31	4.39	5.45	6.20
Water skiing	0.18	0.60	1.08	1.44	2.10	2.72	3.26	3.68
Picnicking	0.14	0.20	0.24	0.30	0.41	0.51	0.60	0.68
Nature walking	0.17	0.20	0.23	0.32	0.44	0.57	0.72	0.89
Hunting	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.18
Camping	--	--	--	--	--	--	--	--
Hiking	--	--	--	--	--	--	--	--
Fishing								
Striped bass	0.54	0.60	0.72	0.90	1.20	1.44	1.68	1.86
Catfish	--	--	--	--	--	--	--	--
Miscellaneous bay angling	0.23	0.23	0.23	0.27	0.36	0.44	0.50	0.53
Ocean and bay salmon	--	--	--	--	--	--	--	--
River salmon	--	--	--	--	--	--	--	--
Unidentified delta angling	--	--	--	--	--	--	--	--
American shad	--	--	--	--	--	--	--	--
Steelhead trout	--	--	--	--	--	--	--	--
Largemouth black bass	--	--	--	--	--	--	--	--
Sturgeon	--	--	--	--	--	--	--	--
Total	$7.51	$10.03	$12.99	$17.11	$24.29	$31.18	$37.34	$42.44

---

* Economic benefits for low unit values are one-third those in this table.

Table 77

ECONOMIC BENEFITS OF RECREATION ACTIVITIES
SOUTH SAN FRANCISCO BAY
HIGH UNIT VALUES, HIGH POPULATION PROJECTIONS

(Millions of Dollars per Year)

Activity	1970	1980	1990	2000	2010	2020
Sunbathing and swimming	$ 7.50	$ 9.98	$15.00	$19.85	$24.38	$28.10
Sightseeing	1.43	2.00	3.00	4.10	5.13	6.06
Boating	1.77	2.36	3.67	5.03	6.32	7.77
Water skiing	1.13	1.53	2.33	3.08	3.84	4.40
Picnicking	0.26	0.32	0.45	0.59	0.72	0.83
Nature walking	0.24	0.33	0.48	0.66	0.87	1.08
Hunting	0.12	0.12	0.12	0.12	0.12	0.24
Camping	--	--	--	--	--	--
Hiking	--	--	--	--	--	--
Fishing						
Striped bass	0.72	0.96	1.32	1.56	1.92	2.10
Catfish	--	--	--	--	--	--
Miscellaneous bay angling	0.23	0.29	0.39	0.48	0.56	0.60
Ocean and bay salmon	--	--	--	--	--	--
River salmon	--	--	--	--	--	--
Unidentified delta angling	--	--	--	--	--	--
American shad	--	--	--	--	--	--
Steelhead trout	--	--	--	--	--	--
Largemouth black bass	--	--	--	--	--	--
Sturgeon	--	--	--	--	--	--
Total	$13.40	$18.02	$26.76	$35.47	$43.86	$51.18

Table 78

ECONOMIC BENEFITS OF RECREATION ACTIVITIES
SOUTH SAN FRANCISCO BAY
LOW UNIT VALUES, LOW POPULATION PROJECTIONS
(Millions of Dollars per Year)

Activity	1970	1980	1990	2000	2010	2020
Sunbathing and swimming	$2.34	$2.99	$4.08	$5.05	$ 5.87	$ 6.42
Sightseeing	0.45	0.61	0.85	1.09	1.29	1.50
Boating	0.56	0.74	1.00	1.28	1.57	1.64
Water skiing	0.35	0.45	0.64	0.79	0.93	1.02
Picnicking	0.08	0.10	0.12	0.15	0.17	0.19
Nature walking	0.07	0.10	0.13	0.17	0.20	0.24
Hunting	0.04	0.04	0.04	0.04	0.04	0.06
Camping	--	--	--	--	--	--
Hiking	--	--	--	--	--	--
Fishing						
Striped bass	0.24	0.28	0.38	0.44	0.50	0.54
Catfish	--	--	--	--	--	--
Miscellaneous bay angling	0.08	0.09	0.11	0.14	0.15	0.16
Ocean and bay salmon	--	--	--	--	--	--
River salmon	--	--	--	--	--	--
Unidentified delta angling	--	--	--	--	--	--
American shad	--	--	--	--	--	--
Steelhead trout	--	--	--	--	--	--
Largemouth black bass	--	--	--	--	--	--
Sturgeon	--	--	--	--	--	--
Total	$4.21	$5.40	$7.35	$9.15	$10.72	$11.77

Table 79

ECONOMIC BENEFITS OF RECREATION ACTIVITIES
CENTRAL SAN FRANCISCO BAY
MEDIUM UNIT VALUES, MEDIAN POPULATION PROJECTIONS
(Millions of Dollars per Year)

Activity	1960	1965	1970	1980	1990	2000	2010	2020
Sunbathing and swimming	$0.47	$0.63	$0.82	$1.08	$ 1.54	$ 1.97	$ 2.33	$ 2.64
Sightseeing	1.55	1.96	2.45	3.41	4.93	6.55	7.97	9.31
Boating	0.17	0.21	0.25	0.32	0.46	0.64	0.77	0.88
Water skiing	0.16	0.54	0.98	1.30	1.89	2.46	2.96	3.33
Picnicking	0.11	0.15	0.20	0.26	0.36	0.46	0.58	0.66
Nature walking	0.07	0.08	0.10	0.14	0.19	0.25	0.32	0.39
Hunting	0.04	0.04	0.09	0.09	0.14	0.18	0.22	0.27
Camping	--	--	--	--	--	--	--	--
Hiking	--	--	--	--	--	--	--	--
Fishing								
Striped bass	0.60	0.66	0.84	1.02	1.46	1.84	2.34	2.70
Catfish	--	--	--	--	--	--	--	--
Miscellaneous bay angling	0.17	0.17	0.18	0.21	0.28	0.34	0.39	0.41
Ocean and bay salmon*	--	--	0.06	0.06	0.06	0.06	0.06	0.06
River salmon	--	--	--	--	--	--	--	--
Unidentified delta angling	--	--	--	--	--	--	--	--
American shad	--	--	--	--	--	--	--	--
Steelhead trout	--	--	--	--	--	--	--	--
Largemouth black bass	--	--	--	--	--	--	--	--
Sturgeon	--	--	--	--	--	--	--	--
Total	$3.35	$4.45	$5.97	$7.89	$11.31	$14.75	$17.94	$20.75

---

* Estimated as 10 percent of party boat angling.

Table 80

ECONOMIC BENEFITS OF RECREATION ACTIVITIES
CENTRAL SAN FRANCISCO BAY
HIGH UNIT VALUES,* MEDIAN POPULATION PROJECTIONS
(Millions of Dollars per Year)

Activity	1960	1965	1970	1980	1990	2000	2010	2020
Sunbathing and swimming	$0.70	$0.94	$1.23	$ 1.62	$ 2.31	$ 2.96	$ 3.50	$ 3.96
Sightseeing	2.32	2.94	3.68	5.12	7.40	9.82	11.96	13.96
Boating	0.16	0.21	0.26	0.33	0.46	0.63	0.76	0.88
Water skiing	0.16	0.54	0.98	1.30	1.89	2.46	2.96	3.33
Picnicking	0.14	0.18	0.24	0.30	0.40	0.50	0.60	0.66
Nature walking	0.10	0.12	0.15	0.21	0.28	0.38	0.48	0.57
Hunting	0.06	0.06	0.12	0.12	0.18	0.24	0.30	0.36
Camping	--	--	--	--	--	--	--	--
Hiking	--	--	--	--	--	--	--	--
Fishing								
Striped bass	1.02	1.14	1.44	1.74	2.34	2.76	3.30	3.60
Catfish	--	--	--	--	--	--	--	--
Miscellaneous bay angling	0.26	0.26	0.27	0.32	0.42	0.51	0.58	0.62
Ocean and bay salmon†	--	--	0.06	0.06	0.06	0.06	0.06	0.06
River salmon	--	--	--	--	--	--	--	--
Unidentified delta angling	--	--	--	--	--	--	--	--
American shad	--	--	--	--	--	--	--	--
Steelhead trout	--	--	--	--	--	--	--	--
Largemouth black bass	--	--	--	--	--	--	--	--
Sturgeon	--	--	--	--	--	--	--	--
Total	$4.94	$6.39	$8.42	$11.12	$15.75	$20.31	$24.50	$28.00

---

* Economic benefits for low unit values are one-third those in this table.

† Estimated as 10 percent of party boat angling.

Table 81

ECONOMIC BENEFITS OF RECREATION ACTIVITIES
CENTRAL SAN FRANCISCO BAY
HIGH UNIT VALUES, HIGH POPULATION PROJECTIONS

(Millions of Dollars per Year)

Activity	1970	1980	1990	2000	2010	2020
Sunbathing and swimming	$1.27	$ 1.71	$ 2.55	$ 3.39	$ 4.15	$ 4.76
Sightseeing	3.78	5.35	8.05	10.98	13.77	16.24
Boating	0.27	0.35	0.52	0.72	0.91	1.10
Water skiing	1.02	1.39	2.09	2.79	3.49	3.99
Picnicking	0.25	0.32	0.41	0.48	0.72	0.81
Nature walking	0.16	0.30	0.32	0.44	0.58	0.72
Hunting	0.04	0.04	0.05	0.07	0.09	0.10
Camping	--	--	--	--	--	--
Hiking	--	--	--	--	--	--
Fishing						
Striped bass	1.47	1.82	2.52	3.02	3.73	4.09
Catfish	--	--	--	--	--	--
Miscellaneous bay angling	0.28	0.33	0.45	0.56	0.66	0.70
Ocean and bay salmon	0.06	0.06	0.06	0.07	0.07	0.07
River salmon	--	--	--	--	--	--
Unidentified delta angling	--	--	--	--	--	--
American shad	--	--	--	--	--	--
Steelhead trout	--	--	--	--	--	--
Largemouth black bass	--	--	--	--	--	--
Sturgeon	--	--	--	--	--	--
Total	$8.67	$11.76	$17.17	$22.71	$28.42	$32.90

Table 82

ECONOMIC BENEFITS OF RECREATION ACTIVITIES
CENTRAL SAN FRANCISCO BAY
LOW UNIT VALUES, LOW POPULATION PROJECTIONS
(Millions of Dollars per Year)

Activity	1970	1980	1990	2000	2010	2020
Sunbathing and swimming	$0.38	$0.51	$0.69	$0.86	$1.00	$1.10
Sightseeing	1.19	1.63	2.26	2.97	3.47	4.01
Boating	0.08	0.10	0.14	0.18	0.22	0.23
Water skiing	0.31	0.41	0.57	0.71	0.84	0.92
Picnicking	0.08	0.09	0.12	0.14	0.16	0.18
Nature walking	0.05	0.07	0.09	0.11	0.13	0.16
Hunting	0.04	0.04	0.05	0.07	0.09	0.10
Camping	--	--	--	--	--	--
Hiking	--	--	--	--	--	--
Fishing						
Striped bass	0.47	0.56	0.72	0.84	0.99	1.06
Catfish	--	--	--	--	--	--
Miscellaneous bay angling	0.09	0.10	0.13	0.16	0.17	0.18
Ocean and bay salmon	0.02	0.02	0.02	0.02	0.02	0.02
River salmon	--	--	--	--	--	--
Unidentified delta angling	--	--	--	--	--	--
American shad	--	--	--	--	--	--
Steelhead trout	--	--	--	--	--	--
Largemouth black bass	--	--	--	--	--	--
Sturgeon	--	--	--	--	--	--
Total	$2.71	$3.53	$4.80	$6.02	$7.09	$7.96

Table 83

ECONOMIC BENEFITS OF RECREATION ACTIVITIES
SAN PABLO BAY
MEDIUM UNIT VALUES, MEDIAN POPULATION PROJECTIONS
(Millions of Dollars per Year)

Activity	1960	1965	1970	1980	1990	2000	2010	2020
Sunbathing and swimming	$0.22	$0.30	$0.40	$0.52	$0.74	$0.94	$1.12	$1.26
Sightseeing	0.29	0.36	0.46	0.64	0.92	1.23	1.50	1.74
Boating	0.16	0.20	0.23	0.30	0.45	0.59	0.71	0.81
Water skiing	0.12	0.41	0.74	0.98	1.43	1.85	2.21	2.49
Picnicking	0.01	0.03	0.04	0.04	0.05	0.07	0.09	0.11
Nature walking	0.01	0.01	0.01	0.01	0.03	0.03	0.04	0.05
Hunting	0.05	0.05	0.09	0.09	0.09	0.09	0.09	0.09
Camping	--	--	--	--	--	--	--	--
Hiking	--	--	--	--	--	--	--	--
Fishing								
Striped bass	0.60	0.70	0.84	1.02	1.43	1.80	2.30	2.66
Catfish	--	--	--	--	--	--	--	--
Miscellaneous bay angling	--	--	--	--	--	--	--	--
Ocean and bay salmon	--	--	--	--	--	--	--	--
River salmon	--	--	--	--	--	--	--	--
Unidentified delta angling	--	--	--	--	--	--	--	--
American shad	--	--	--	--	--	--	--	--
Steelhead trout	--	--	--	--	--	--	--	--
Largemouth black bass	--	--	--	--	--	--	--	--
Sturgeon		0.04	0.04	0.05	0.05	0.06	0.12	0.18
Total	$1.46	$2.10	$2.85	$3.65	$5.19	$6.66	$8.18	$9.39

Table 84

ECONOMIC BENEFITS OF RECREATION ACTIVITIES
SAN PABLO BAY
HIGH UNIT VALUES,* MEDIAN POPULATION PROJECTIONS
(Millions of Dollars per Year)

Activity	1960	1965	1970	1980	1990	2000	2010	2020
Sunbathing and swimming	$0.33	$0.45	$0.60	$0.78	$1.11	$1.41	$ 1.68	$ 1.89
Sightseeing	0.44	0.54	0.69	0.96	1.38	1.85	2.25	2.61
Boating	0.16	0.20	0.23	0.31	0.46	0.59	0.71	0.81
Water skiing	0.12	0.41	0.74	0.98	1.43	1.85	2.21	2.49
Picnicking	0.02	0.03	0.05	0.05	0.06	0.08	0.09	0.11
Nature walking	0.02	0.02	0.02	0.02	0.05	0.05	0.06	0.08
Hunting	0.06	0.06	0.12	0.12	0.12	0.12	0.12	0.12
Camping	--	--	--	--	--	--	--	--
Hiking	--	--	--	--	--	--	--	--
Fishing								
Striped bass	1.02	1.20	1.44	1.74	2.28	2.70	3.24	3.54
Catfish	--	--	--	--	--	--	--	--
Miscellaneous bay angling	--	--	--	--	--	--	--	--
Ocean and bay salmon	--	--	--	--	--	--	--	--
River salmon	--	--	--	--	--	--	--	--
Unidentified delta angling	--	--	--	--	--	--	--	--
American shad	--	--	--	--	--	--	--	--
Steelhead trout	--	--	--	--	--	--	--	--
Largemouth black bass	--	--	--	--	--	--	--	--
Sturgeon	0	0.06	0.06	0.06	0.06	0.06	0.12	0.18
Total	$2.17	$2.97	$3.95	$5.02	$6.95	$8.71	$10.48	$11.83

---

* Economic benefits for low unit values are one-third those in this table.

Table 85

ECONOMIC BENEFITS OF RECREATION ACTIVITIES
SAN PABLO BAY
HIGH UNIT VALUES, HIGH POPULATION PROJECTIONS
(Millions of Dollars per Year)

Activity	1970	1980	1990	2000	2010	2020
Sunbathing and swimming	$0.62	$0.83	$1.23	$1.62	$ 2.00	$ 2.27
Sightseeing	0.71	1.01	1.50	2.07	2.58	3.03
Boating	0.23	0.32	0.50	0.67	0.84	1.03
Water skiing	0.77	1.04	1.58	2.09	2.61	2.99
Picnicking	0.05	0.05	0.06	0.09	0.11	0.14
Nature walking	0.02	0.02	0.05	0.05	0.08	0.09
Hunting	0.12	0.12	0.12	0.12	0.12	0.12
Camping	--	--	--	--	--	--
Hiking	--	--	--	--	--	--
Fishing						
Striped bass	1.50	1.80	2.46	2.94	3.66	4.02
Catfish	--	--	--	--	--	--
Miscellaneous bay angling	--	--	--	--	--	--
Ocean and bay salmon	--	--	--	--	--	--
River salmon	--	--	--	--	--	--
Unidentified delta angling	--	--	--	--	--	--
American shad	--	--	--	--	--	--
Steelhead trout	--	--	--	--	--	--
Largemouth black bass	--	--	--	--	--	--
Sturgeon	0.06	0.06	0.06	0.06	0.12	0.18
Total	$4.08	$5.25	$7.56	$9.71	$12.12	$13.87

Table 86

ECONOMIC BENEFITS OF RECREATION ACTIVITIES
SAN PABLO BAY
LOW UNIT VALUES, LOW POPULATION PROJECTIONS
(Millions of Dollars per Year)

Activity	1970	1980	1990	2000	2010	2020
Sunbathing and swimming	$0.20	$0.25	$0.34	$0.41	$0.48	$0.53
Sightseeing	.23	.31	.42	.55	.66	0.75
Boating	.08	.10	.14	.18	.21	0.22
Water skiing	.24	.31	.43	.54	.63	0.69
Picnicking	.01	.02	.02	.02	.03	0.03
Nature walking	.01	.01	.02	.02	.02	0.02
Hunting	.04	.04	.04	.04	.04	0.04
Camping	--	--	--	--	--	--
Hiking	--	--	--	--	--	--
Fishing						
Striped bass	.46	.56	.70	.82	.96	1.04
Catfish	--	--	--	--	--	--
Miscellaneous bay angling	--	--	--	--	--	--
Ocean and bay salmon	--	--	--	--	--	--
River salmon	--	--	--	--	--	--
Unidentified delta angling	--	--	--	--	--	--
American shad	--	--	--	--	--	--
Steelhead trout	--	--	--	--	--	--
Largemouth black bass	--	--	--	--	--	--
Sturgeon	.02	.02	.02	.02	.04	0.06
Total	$1.29	$1.62	$2.13	$2.60	$3.07	$3.38

Table 87

ECONOMIC BENEFITS OF RECREATION ACTIVITIES
SUISUN BAY
MEDIUM UNIT VALUES, MEDIAN POPULATION PROJECTIONS

(Millions of Dollars per Year)

Activity	1960	1965	1970	1980	1990	2000	2010	2020
Sunbathing and swimming	$0.04	$0.05	$0.06	$0.09	$0.12	$0.16	$0.19	$0.21
Sightseeing	.28	.36	.46	.64	0.91	1.22	1.48	1.72
Boating	.40	.51	.60	.83	1.19	1.56	1.94	2.19
Water skiing	.06	.18	.35	.47	0.66	0.86	1.04	1.17
Picnicking	--	--	--	--	0.01	0.01	0.02	0.02
Nature walking	--	--	--	--	--	--	--	--
Hunting	.27	.27	.32	.32	0.32	0.32	0.32	0.36
Camping	--	--	--	--	--	--	--	--
Hiking	--	--	--	--	--	--	--	--
Fishing								
Striped bass	.28	.32	.35	.46	0.64	0.80	1.02	1.17
Catfish	--	--	--	--	--	--	--	--
Miscellaneous bay angling	--	--	--	--	--	--	--	--
Ocean and bay salmon	--	--	--	--	--	--	--	--
River salmon	--	--	--	--	--	--	--	--
Unidentified delta angling	--	--	--	--	--	--	--	--
American shad	--	--	--	--	--	--	--	--
Steelhead trout	--	--	--	--	--	--	--	--
Largemouth black bass	--	--	--	--	--	--	--	--
Sturgeon	--	--	--	--	--	--	--	--
Total	$1.33	$1.69	$2.14	$2.81	$3.85	$4.93	$6.00	$6.84

Table 88

ECONOMIC BENEFITS OF RECREATION ACTIVITIES
SUISUN BAY
HIGH UNIT VALUES,* MEDIAN POPULATION PROJECTIONS
(Millions of Dollars per Year)

Activity	1960	1965	1970	1980	1990	2000	2010	2020
Sunbathing and swimming	$0.06	$0.075	$0.09	$0.14	$0.18	$0.24	$0.29	$0.32
Sightseeing	.42	.54	.69	.96	1.37	1.83	2.22	2.58
Boating	.41	.51	.60	.83	1.19	1.56	1.94	2.19
Water skiing	.06	.18	.35	.47	.66	.86	1.04	1.17
Picnicking	--	--	--	--	0.02	0.02	0.02	0.02
Nature walking	--	--	--	--	--	--	--	--
Hunting	.36	.36	.42	.42	0.42	0.42	0.42	0.48
Camping	--	--	--	--	--	--	--	--
Hiking	--	--	--	--	--	--	--	--
Fishing								
Striped bass	.48	.54	.60	.78	1.02	1.20	1.44	1.56
Catfish	--	--	--	--	--	--	--	--
Miscellaneous bay angling	--	--	--	--	--	--	--	--
Ocean and bay salmon	--	--	--	--	--	--	--	--
River salmon	--	--	--	--	--	--	--	--
Unidentified delta angling	--	--	--	--	--	--	--	--
American shad	--	--	--	--	--	--	--	--
Steelhead trout	--	--	--	--	--	--	--	--
Largemouth black bass	--	--	--	--	--	--	--	--
Sturgeon	--	--	--	--	--	--	--	--
Total	$1.79	$2.20	$2.75	$3.60	$4.86	$6.12	$7.36	$8.32

---

* Economic benefits for low unit values are one-third those in this table.

Table 89

ECONOMIC BENEFITS OF RECREATION ACTIVITIES
SUISUN BAY
HIGH UNIT VALUES, HIGH POPULATION PROJECTIONS
(Millions of Dollars per Year)

Activity	1970	1980	1990	2000	2010	2020
Sunbathing and swimming	$0.09	$0.15	$0.20	$0.29	$0.35	$0.38
Sightseeing	0.71	1.01	1.49	2.04	2.55	3.00
Boating	0.62	0.87	1.32	1.79	2.28	2.75
Water skiing	0.36	0.50	0.74	0.98	1.22	1.40
Picnicking	0	0	0.02	0.02	0.02	0.02
Nature walking	--	--	--	--	--	--
Hunting	0.42	0.42	0.48	0.48	0.48	0.60
Camping	--	--	--	--	--	--
Hiking	--	--	--	--	--	--
Fishing						
Striped bass	0.60	0.84	1.08	1.32	1.62	1.80
Catfish	--	--	--	--	--	--
Miscellaneous bay angling	--	--	--	--	--	--
Ocean and bay salmon	--	--	--	--	--	--
River salmon	--	--	--	--	--	--
Unidentified delta angling	--	--	--	--	--	--
American shad	--	--	--	--	--	--
Steelhead trout	--	--	--	--	--	--
Largemouth black bass	--	--	--	--	--	--
Sturgeon	--	--	--	--	--	--
Total	$2.80	$3.79	$5.33	$6.92	$8.52	$9.95

Table 90

ECONOMIC BENEFITS OF RECREATION ACTIVITIES
SUISUN BAY
LOW UNIT VALUES, LOW POPULATION PROJECTIONS
(Millions of Dollars per Year)

Activity	1970	1980	1990	2000	2010	2020
Sunbathing and swimming	$0.03	$0.04	$0.06	$0.07	$0.08	$0.09
Sightseeing	.23	.31	.42	.55	.65	.74
Boating	.20	.26	.36	.46	.55	.58
Water skiing	.11	.15	.20	.25	.30	.33
Picnicking	0	0	.01	.01	.01	.01
Nature walking	--	--	--	--	--	--
Hunting	.14	.14	.12	.12	.12	.14
Camping	--	--	--	--	--	--
Hiking	--	--	--	--	--	--
Fishing						
Striped bass	.20	.26	.32	.36	.44	.46
Catfish	--	--	--	--	--	--
Miscellaneous bay angling	--	--	--	--	--	--
Ocean and bay salmon	--	--	--	--	--	--
River salmon	--	--	--	--	--	--
Unidentified delta angling	--	--	--	--	--	--
American shad	--	--	--	--	--	--
Steelhead trout	--	--	--	--	--	--
Largemouth black bass	--	--	--	--	--	--
Sturgeon	--	--	--	--	--	--
Total	$0.91	$1.16	$1.49	$1.82	$2.15	$2.35

Table 91

ECONOMIC BENEFITS OF RECREATION ACTIVITIES
DELTA
MEDIUM UNIT VALUES, MEDIAN POPULATION PROJECTIONS
(Millions of Dollars per Year)

Activity	1960	1965	1970	1980	1990	2000	2010	2020
Sunbathing and swimming	$0.27	$0.35	$ 0.47	$ 0.61	$ 0.88	$ 1.12	$ 1.33	$ 1.50
Sightseeing	0.75	0.95	1.19	1.66	2.40	3.19	3.88	4.53
Boating	1.00	1.28	1.52	2.09	2.93	3.91	4.85	5.49
Water skiing	0.21	0.69	1.25	1.68	2.43	3.15	3.78	4.28
Picnicking	0.30	0.41	0.53	0.69	0.97	1.26	1.55	1.80
Nature walking	0.07	0.08	0.09	0.12	0.17	0.22	0.29	0.34
Hunting	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Camping	0.08	0.15	0.26	0.32	0.42	0.53	0.62	0.69
Hiking	0.01	0.02	0.03	0.04	0.06	0.08	0.09	0.10
Fishing								
Striped bass	2.77	3.36	3.99	4.83	6.86	10.40	11.05	12.92
Catfish	0.45	0.53	0.61	0.73	1.25	1.55	2.24	2.48
Miscellaneous bay angling	--	--	--	--	--	--	--	--
Ocean and bay salmon	--	--	--	--	--	--	--	--
River salmon	--	--	--	--	--	--	--	--
Unidentified delta angling	0.20	0.23	0.28	0.33	0.50	0.61	0.78	0.87
American shad	--	--	--	--	--	--	--	--
Steelhead trout	--	--	--	--	--	--	--	--
Largemouth black bass	0.02	0.02	0.03	0.03	0.03	0.05	0.06	0.06
Sturgeon	--	--	--	--	--	--	--	--
Total	$6.22	$8.16	$10.34	$13.22	$18.99	$26.16	$30.61	$35.15

Table 92

ECONOMIC BENEFITS OF RECREATION ACTIVITIES
DELTA
HIGH UNIT VALUES,* MEDIAN POPULATION PROJECTIONS
(Millions of Dollars per Year)

Activity	1960	1965	1970	1980	1990	2000	2010	2020
Sunbathing and swimming	$0.41	$ 0.53	$ 0.71	$ 0.92	$ 1.32	$ 1.68	$ 2.00	$ 2.25
Sightseeing	1.12	1.43	1.79	2.49	3.60	4.79	5.82	6.80
Boating	1.00	1.28	1.52	2.09	2.93	3.91	4.85	5.49
Water skiing	0.21	0.69	1.25	1.68	2.43	3.15	3.78	4.28
Picnicking	0.36	0.50	0.63	0.80	1.08	1.35	1.61	1.80
Nature walking	0.11	0.12	0.14	0.18	0.26	0.33	0.44	0.51
Hunting	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Camping	0.08	0.15	0.26	0.32	0.42	0.53	0.62	0.69
Hiking	0.02	0.03	0.05	0.06	0.09	0.12	0.14	0.15
Fishing								
Striped bass	4.74	5.76	6.84	8.28	10.98	15.60	15.60	17.22
Catfish	0.68	0.80	0.92	1.10	1.50	1.86	2.24	2.48
Miscellaneous bay angling	--	--	--	--	--	--	--	--
Ocean and bay salmon	--	--	--	--	--	--	--	--
River salmon	--	--	--	--	--	--	--	--
Unidentified delta angling	0.48	0.54	0.66	0.78	1.08	1.32	1.56	1.74
American shad	--	--	--	--	--	--	--	--
Steelhead trout	--	--	--	--	--	--	--	--
Largemouth black bass	0.02	0.02	0.03	0.03	0.03	0.05	0.06	0.06
Sturgeon	--	--	--	--	--	--	--	--
Total	$9.35	$11.97	$14.92	$18.85	$25.84	$34.82	$38.84	$43.59

---

* Economic benefits for low unit values are one-third those in this table.

Table 93

ECONOMIC BENEFITS OF RECREATION ACTIVITIES
DELTA
HIGH UNIT VALUES, HIGH POPULATION PROJECTIONS
(Millions of Dollars per Year)

Activity	1970	1980	1990	2000	2010	2020
Sunbathing and swimming	$ 0.74	$ 0.96	$ 1.46	$ 1.92	$ 2.37	$ 2.70
Sightseeing	1.83	2.61	3.92	5.36	6.71	7.91
Boating	1.56	2.21	3.25	4.48	5.74	6.89
Water skiing	1.29	1.79	2.69	3.59	4.47	5.12
Picnicking	0.66	0.86	1.20	1.56	1.94	2.21
Nature walking	0.14	0.20	0.29	0.39	0.53	0.63
Hunting	0.12	0.12	0.12	0.12	0.12	0.12
Camping	0.26	0.33	0.45	0.62	0.71	0.80
Hiking	0.05	0.06	0.11	0.14	0.17	0.18
Fishing						
Striped bass	7.02	8.64	11.82	17.04	17.64	19.56
Catfish	0.93	1.14	1.62	2.04	2.54	2.88
Miscellaneous bay angling	--	--	--	--	--	--
Ocean and bay salmon	--	--	--	--	--	--
River salmon	--	--	--	--	--	--
Unidentified delta angling	0.66	0.84	1.14	1.44	1.74	1.98
American shad	--	--	--	--	--	--
Steelhead trout	--	--	--	--	--	--
Largemouth black bass	0.12	0.12	0.12	0.18	0.30	0.30
Sturgeon	--	--	--	--	--	--
Total	$15.38	$19.88	$28.19	$38.88	$44.98	$51.21

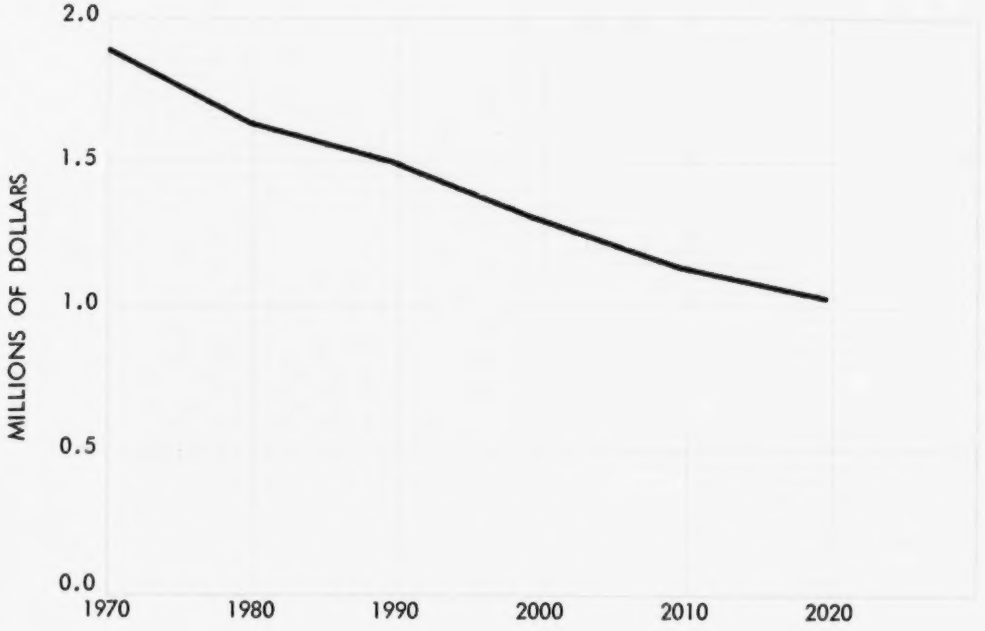
Table 94

ECONOMIC BENEFITS OF RECREATION ACTIVITIES
DELTA
LOW UNIT VALUES, LOW POPULATION PROJECTIONS
(Millions of Dollars per Year)

Activity	1970	1980	1990	2000	2010	2020
Sunbathing and swimming	$0.23	$0.29	$0.40	$ 0.49	$ 0.57	$ 0.63
Sightseeing	0.58	0.79	1.10	1.43	1.69	1.95
Boating	0.49	0.67	0.88	1.14	1.36	1.44
Water skiing	0.40	0.53	0.73	0.92	1.08	1.18
Picnicking	0.21	0.25	0.33	0.39	0.44	0.49
Nature walking	0.05	0.06	0.08	0.10	0.12	0.14
Hunting	0.04	0.04	0.04	0.04	0.04	0.04
Camping	0.09	0.10	0.13	0.17	0.18	0.20
Hiking	0.02	0.02	0.03	0.04	0.04	0.04
Fishing						
Striped bass	2.22	2.66	3.40	4.76	4.66	5.06
Catfish	0.30	0.35	0.46	0.57	0.67	0.73
Miscellaneous bay angling	--	--	--	--	--	--
Ocean and bay salmon	--	--	--	--	--	--
River salmon	--	--	--	--	--	--
Unidentified delta angling	0.22	0.26	0.34	0.40	0.46	0.52
American shad	--	--	--	--	--	--
Steelhead trout	--	--	--	--	--	--
Largemouth black bass	0.01	0.01	0.01	0.02	0.02	0.02
Sturgeon	--	--	--	--	--	--
Total	$4.86	$6.03	$7.93	$10.47	$11.33	$12.44

FIGURE 14

ECONOMIC BENEFITS OF COMMERCIAL FISHING
San Francisco Bay



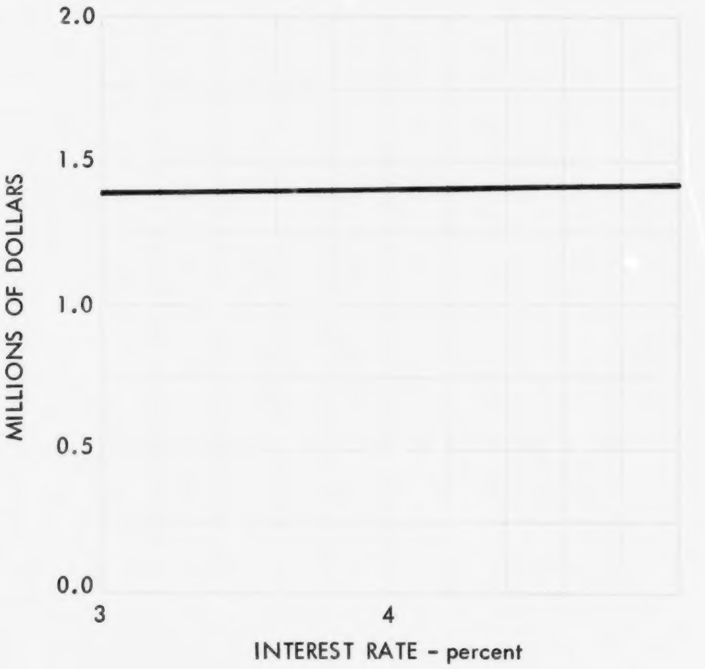


FIGURE 15

ANNUAL
NET ECONOMIC
BENEFITS OF
COMMERCIAL FISHING

XVI BIBLIOGRAPHY

Barrett, Elinore M., "The California Oyster Industry," Fish Bull. No. 123, Calif. Dept. of Fish and Game, 1963

Baxter, John, L., and **Parke** H. Young, "An Evaluation of the Marine Sportfishing Record System in California," Calif. Fish and Game, Vol. 39, No. 3, 1953

Bjornm, Ted C., Statewide Fishing Harvest Survey, 1960, Idaho Dept. of Fish and Game, Annual Progress Report for Investigations Project F-18-R-7, 1961

Calhoun, A. J., "California Striped Bass Catch Records from the Party Boat Fishery: 1938-1948," Calif. Fish and Game, Vol. 35, No. 4, 1949

__________, "California Angling Catch Records from Postal Surveys: 1936-1958;" with an evaluation of postal card nonresponse. Calif. Fish and Game, Vol. 36, No. 3, 1950

California, Bureau of Marine Fisheries, "The Commercial Fish Catch of California for the Year 1947, with an Historical Review 1916-1947," Fish Bull. No. 74, 1949

California Department of Fish and Game, California Ocean Fisheries Resources to the year 1960, 1961

California Resources Agency, Department of Parks and Recreation, Recreation and Parks Study, Part II, An Element of the State Resources Development Program, Sacramento, 1965

__________, Division of Small Craft Harbors, Boating Facilities Inventory for San Francisco Bay and Delta Regions, Sacramento, 1964

__________, The California Boating Plan, Sacramento, 1964

__________, Division of Small Craft Harbors Boating Facilities Guide, Central Area, Sacramento, 1965

__________, Inventory Summary of Proposed Boating Facilities, Sacramento, May 1965

__________, Numbers of Vessels Registered to Date, Sacramento, 1965

__________, Division of Beaches and Parks, Parks Are Forever, Sacramento, undated

Preceding page blank

California Resources Agency, Division of Recreation, *California Recreation and Park Directory*, Sacramento, 1965

California State Department of Water Resources, *Recreation*, Appendix to Bulletin No. 76, Delta Water Facilities (Preliminary Edition), 1962

California Department of Water Resources, Division of Resources Planning, *A Method of Forecast of Statewide Recreation Demand*, Sacramento, 1963

Chadwick, Harold K., "Catch Records from the Striped Bass Sport Fishery in California," *Calif. Fish and Game*, Vol. 48, No. 3, 1962

Chadwick, Harold K. and Arnold B. Albrecht, *The Summer and Fall Striped Bass Fishery During 1960 and 1961*, Calif. Dept. of Fish and Game, Inland Fisheries Branch Admin. Report No. 65-11, 1965

Clark, Frances, N., "California Marine and Fresh Water Sport Fishing Intensity in 1951," *Calif. Fish and Game*, Vol. 39, No. 1, 1953

Clark, G. H., "Sacramento-San Joaquin Salmon (*Oncorhynchus tschawytscha*) Fishery of California," *Fish Bull. No. 17*, Calif. Dept. of Fish and Game, 1929

Clark, G. H. and Hatton S. Ross, "Progress Report on Adult Salmon Tagging in 1939-1941," *Calif. Fish and Game*, Vol. 28, No. 2, 1942

Clawson, M., *Methods of Measuring the Demand For and Value of Outdoor Recreation*, Reprint No. 10, Washington, D.C., RFF, February 1959

__________, *Statistics on Outdoor Recreation*, Washington, D.C., RFF, 1958

Cope, Oliver B. and Leo F. Erkkila, "Weekday Angling Pressure in the Sacramento-San Joaquin Delta, 1948 and 1949," *Calif. Fish and Game*, Vol. 38, No. 1, 1952

Crutchfield, J., "Valuation of Fishery Resources," *Land Economics*, May 1962

Davis, R. K., "The Economics of Recreational Development in the Maine Woods," Ph.D. Thesis, Harvard University, 1963

Dralle, P. J., *Sacramento River Salmon and Steelhead Sport Catch, 1962-63*, Calif. Dept. of Fish and Game, Marine Resources Branch Admin. Report No. 65-5, 1965

Fry, Donald H., Jr., and Eldon P. Hughes, *The California Salmon Troll Fishery*, In: Bull. No. 2, Pacific Marine Fish. Comm., Portland, Oregon, 1951

Hallock, Richard J., William Van Woert and Leo Shapovalov, "An Evaluation of Stocking Hatchery-Reared Steelhead Rainbow Trout (*Salmo gairdnerii gairdnerii*) in the Sacramento River System," *Fish Bull. No. 114*, Calif. Dept. of Fish and Game, 1961

Jensen, Paul T., "Landing Estimates of California's Marine Recreational Salmon Fishery," *Calif. Fish and Game*, Vol. 50, No. 1, 1964

Johnson, William C., *The Reliability of the Striped Bass Party Boat Catch Records*, Report to the Bureau of Fish Conservation, Calif. Div. of Fish and Game, January 9, 1951, 1951

Kneese, A. V., *Water Pollution: Economic Aspects and Research Needs*, Washington, D.C., RFF, 1962

Knetsch, J., "Outdoor Recreation Demands and Benefits," *Land Economics*, November 1963

Miller, Daniel J., *A Field Guide to Some Common Ocean Sport Fishes of California, Part I, revised February 1960*, Calif. Dept. of Fish and Game, 1959

Miller, Daniel J., Daniel Gotshall and Richard Nitsos, *A Field Guide to Some Common Ocean Sport Fishes of California, Part II*, Calif. Dept. of Fish and Game, 1961

Miller, Daniel J., and Daniel Gotshall, "Ocean Sportfish Catch and Effort from Oregon to Point Arguello, California," *Fish Bull. No. 130*, Calif. Dept. of Fish and Game, Marine Resources Operations, 1965

Outdoor Recreation Resources Review Commission, Study Report 5, *The Quality of Outdoor Recreation: As Evidenced by User Satisfaction*, Washington, D.C., 1962

__________, Study Report 19, *National Recreation Survey*, Washington, D.C., 1962

__________, Study Report 20, *Participation in Outdoor Recreation, Factors Affecting Demand Among American Adults*, Washington, D.C., 1962

__________, Study Report 24, *Economic Studies of Outdoor Recreation*, Washington, D.C., 1962

Pacific Salmon Interagency Council, Status of Major North American Stocks of Pacific Salmon, Report Number 3, 1964

Pearson, Erman A., "Reduced Area," investigation of San Francisco Bay for California State Water Pollution Control Board, 1958

Pelgen, David E., *Fish and Wildlife*, Appendix C of Report to the Water Project Authority on Feasibility of Construction by the State of Barriers in the San Francisco Bay System, State of Calif., Dept. of Public Works, Div. of Water Resources, 1955

Pelgen, David E., "Economic Values of Striped Bass, Salmon and Steelhead Sport Fishing in California," *Calif. Fish and Game*, Vol. 41, No. 1, 1955

Prewitt, R. A., *The Economics of Public Recreation - An Economic Study of the Monetary Evaluation of Recreation in the National Parks*, National Park Service, 1949

Resources for the Future, *Methods of Measuring the Demand for and Value of Outdoor Recreation*, Washington, D.C., 1959

__________, *Statistical Data Available for Economic Research on Certain Types of Recreation*, Washington, D.C., 1959

Ryan, James H., "California Inland Angling Estimates for 1954, 1956 and 1957," *Calif. Fish and Game*, Vol. 45, No. 2, 1959

Scott,Mel, *The Future of San Francisco Bay*, Univ. of Calif., Berkeley, Institute of Governmental Studies, 1963

Skinner, John E., "California Statewide Angling Estimates for 1953," *Calif. Fish and Game*, Vol. 41, No. 1, 1955

__________, *An Historical Review of the Fish and Wildlife Resources of the San Francisco Bay Area*, Calif. Dept. of Fish and Game, Water Projects Branch, Report No. 1, 1962

Stanford Research Institute, *Recreation and Parks Study, Part I, An Element of the State Resources Development Program*, South Pasadena, 1965

State of California, *Sacramento River and Delta Recreation Study*, Report to the Governor of the Sacramento River and Delta Recreation Study Committee, Calif. Dept. Natural Resources, 1961

Tolley, G. S., and E. C. Harrell, "Extensions of Benefit-Cost Analysis," *American Economic Review*, May 1962

Wendler, Henry O., "The Importance of the Ocean Sport Fishery to the Ocean Catch of Salmon in the States of Washington, Oregon and California," *Calif. Fish and Game*, Vol. 46, No. 3, 1960

Van Woert, William, *Central Valley Salmon and Steelhead Sport Catch*, 1963-64, Calif. Dept. of Fish and Game, Marine Resources Branch Admin. Report No. 65-5, 1965

Wollman, N., *The Value of Water in Alternative Uses*, University of New Mexico Press, Albuquerque, 1962

Appendix A

POSSIBLE DEVIATIONS FROM MEDIAN PROJECTIONS

Appendix A

POSSIBLE DEVIATIONS FROM MEDIAN PROJECTIONS

Possible errors in the distant future--errors in either magnitude of the population of the 11-county area or per capita participation rates--can result in deviations from the median projection figures presented in this report. The figures presented here are considered most likely to be representative of future conditions, although the possibility of variations from them are recognized.

Three population projection levels for the 1970-2020 period were provided by the Federal Water Pollution Control Administration. These three projections, however, cover only the 11-county area. Only one population projection was available for the other two groups of participants--other California residents and other U.S. residents.

Table 95 summarizes the variations in estimates of total annual potential demand and recreation use of all types of participants based only on variations in population projections for residents of the 11-county area. If the population projections for other California residents and other U.S. residents are subject to the same possible deviation from the median as are those for the 11-county area, then the percentage variations in Table 95 should each be increased approximately 60 percent. In other words, the percentage variation possible for sunbathing and swimming in 2020 would be increased from the -10.6 to +12.6 percent range to a -16.4 to +19.5 percent range. The calculations on which this possible 60 percent increase is based are shown in the following tabulations:

	11-County Area Residents	All Other California Residents	All Other U.S. Residents	Total
Estimates of swimming and sunbathing for 2020				
Based on median population estimates				
Median population estimate (thousands)	16,188	38,762	315,100	370,500
Potential demand (millions of participation days)	99.6	29.0	25.3	153.9

Preceding page blank

	11-County Area Residents	All Other California Residents	All Other U.S. Residents	Total
Estimates of swimming and sunbathing for 2020 (cont.)				
Based on variations in 11-county area population				
Population estimate (thousands)				
High	19,256	38,762	315,100	373,568
Low	13,483	38,762	315,100	367,795
Potential demand (millions of participation days)				
High	118.5	29.0	25.3	172.8
Low	83.0	29.0	25.3	137.3
Based on proportional variations in all population estimates				
Population estimate (thousands)				
High	19,256	46,108	374,800	440,164
Low	13,483	32,285	262,400	308,168
Potential demand (millions of participation days)				
High	118.5	34.5	30.1	183.1
Low	83.0	24.2	21.1	128.3

Variations resulting from these differences in population projections would be as shown in Table 96, assuming that low and high population projections for other California residents and other U.S. residents varied from the median in the same manner that projections for the 11-county area residents varied.

Table 95

VARIATIONS IN ESTIMATES OF TOTAL ANNUAL POTENTIAL DEMAND AND RECREATIONAL USE OF ALL PERSONS EXERCISED IN THE STUDY AREA FOR HIGH AND LOW POPULATION PROJECTIONS*

1970–2020
(Percentages)

Activity	1970		1980		1990		2000		2010		2020	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Sunbathing and swimming	-2.1%	+2.1%	-3.5%	+3.5%	-6.2%	+6.5%	-7.9%	+9.1%	-9.0%	+11.6%	-10.6%	+12.6%
Sightseeing	-1.8	+1.8	-2.9	+2.9	-5.2	+5.5	-6.7	+7.4	-8.1	+9.5	-8.6	+10.2
Fishing	-1.5	+1.5	-2.3	+2.9	-4.5	+4.9	-5.2	+5.9	-6.7	+8.2	-7.4	+8.5
Motor boating	-2.0	+2.0	-3.0	+3.7	-5.8	+6.8	-7.9	+9.1	-9.9	+11.4	-13.3	+16.0
Water skiing	-2.6	+2.6	-3.9	+3.9	-6.0	+6.7	-8.1	+8.3	-9.6	+11.3	-10.8	+12.3
Picnicking	-2.0	+2.8	-3.3	+4.2	-6.6	+7.2	-8.6	+10.0	-11.0	+12.6	-11.7	+14.0
Nature walks	-2.5	+2.5	-3.8	+3.8	-6.6	+7.3	-8.7	+10.2	-11.1	+13.1	-12.1	+14.1
Hunting	-1.8	+1.8	-3.6	+3.6	-5.9	+5.9	-6.9	+7.4	-7.8	+8.9	-9.5	+12.5
Camping	-1.6	+1.8	-3.1	+3.5	-4.6	+5.2	-6.5	+7.0	-7.3	+8.8	-8.1	+9.7
Sailing	-2.6	+2.6	-5.2	+5.3	-7.3	+7.4	-8.5	+8.6	-9.8	+11.6	-10.6	+12.5
Hiking	-2.1	+2.1	-3.1	+3.1	-7.4	+7.5	-9.0	+9.8	-10.9	+12.9	-12.1	+13.9

---

* Based only on variations in population projections of 11-county area residents.

Source: Stanford Research Institute.

Table 96

VARIATIONS IN ESTIMATES OF TOTAL ANNUAL POTENTIAL DEMAND AND RECREATIONAL USE FOR HIGH AND LOW POPULATION PROJECTIONS*
1970-2020
(Percentages)

Year	Low	High
1970	-2.9%	+3.0%
1980	-5.1	+5.4
1990	-9.1	+10.1
2000	-12.1	+13.9
2010	-15.0	+17.5
2020	-16.4	+19.5

---

* Assuming variations in other California and other U.S. populations deviated from median in proportion to variations of high and low projections of 11-county residents from median.

Source: Stanford Research Institute.

Estimates of per capita participation are also subject to variations from the median figure used. These variations become pronounced for years following 2000. As shown in Table 97, such variations are relatively small for sightseeing, motor boating, and sailing, but they are large for hunting, camping, and water skiing.

Table 97

PROBABLE DEVIATION OF PER CAPITA PARTICIPATION DAY ESTIMATES FROM ESTIMATES USED IN REPORT

(Percentages)

Activity	1970	1980	1990	2000	2010	2020
Sunbathing and swimming						
Maximum	+3.5%	+6.7%	+11.0%	+17.7%	+27.4%	+37.5%
Minimum	-3.5	-6.7	-11.0	-17.7	-29.8	-46.8
Sightseeing						
Maximum	+1.0	+1.0	+3.1	+5.7	+8.7	+12.7
Minimum	-1.6	-3.0	-4.3	-6.9	-9.8	-13.2
Fishing						
Maximum	+1.3	+3.2	+8.1	+16.5	+30.3	+50.3
Minimum	-1.7	-3.6	-8.1	-16.5	-30.3	-50.3
Motor boating						
Maximum	+0.0	+0.0	+1.9	+3.4	+5.0	+6.5
Minimum	-2.2	-4.5	-6.1	-7.7	-9.4	-11.5
Water skiing						
Maximum	+4.8	+10.0	+15.3	+26.2	+40.7	+53.7
Minimum	-5.8	-10.0	-15.3	-26.2	-40.7	-60.2
Picnicking						
Maximum	+1.2	+2.2	+5.9	+10.7	+15.4	+20.7
Minimum	-2.2	-4.2	-6.7	-10.9	-16.2	-24.2
Nature walking						
Maximum	+0.0	+0.0	+6.0	+11.6	+18.6	+26.1
Minimum	-0.9	-1.6	-6.0	-11.6	-18.6	-26.1
Hunting						
Maximum	+1.9	+1.9	+27.2	+65.8	+107.3	+177.7
Minimum	-7.7	-15.8	-23.3	-36.3	-43.9	-52.2
Camping						
Maximum	+3.8	+8.5	+20.1	+42.8	+52.7	+61.5
Minimum	-1.5	-6.3	-20.1	-42.8	-52.7	-51.7
Sailing						
Maximum	+2.4	+2.4	+2.4	+6.7	+8.5	+10.2
Minimum	-2.4	-2.4	-4.6	-6.7	-8.5	-12.3
Hiking						
Maximum	+2.8	+4.5	+14.5	+20.7	+28.8	+40.7
Minimum	-5.7	-9.7	-15.0	-20.8	-28.8	-40.7
Average of all activities						
Maximum	+2.1	+3.7	+10.6	+20.7	+31.2	+45.2
Minimum	-3.7	-5.6	-11.0	-18.5	-26.2	-35.3

Source: Stanford Research Institute.

Appendix B

POPULATION PROJECTIONS

Preceding page blank

Table 98

POPULATION PROJECTIONS USED
1950-2020
(In Thousands)

Year	11-County Area*			Other California †	Other United States ‡
	Low	Median	High		
1950	3,159.2	3,159.2	3,159.2	7,426.4	140,600
1960	4,391.7	4,391.7	4,391.7	11,325.5	163,600
1970	5,822.0	5,998.0	6,179.0	15,924.3	189,200
1980	6,800.0	7,167.0	7,555.0	20,509.5	220,800
1990	8,867.0	9,758.0	10,739.0	25,243.6	245,000
2000	10,657.0	12,126.0	13,806.0	28,989.0	268,900
2010	12,442.0	14,603.0	17,152.0	33,301.8	292,100
2020	13,483.0	16,188.0	19,256.0	38,762.2	315,100

---

* Projections prepared by Mr. A. R. Blanch, Regional Economist, Central Pacific River Basins Comprehensive Water Pollution Control Project, Federal Water Pollution Control Administration.

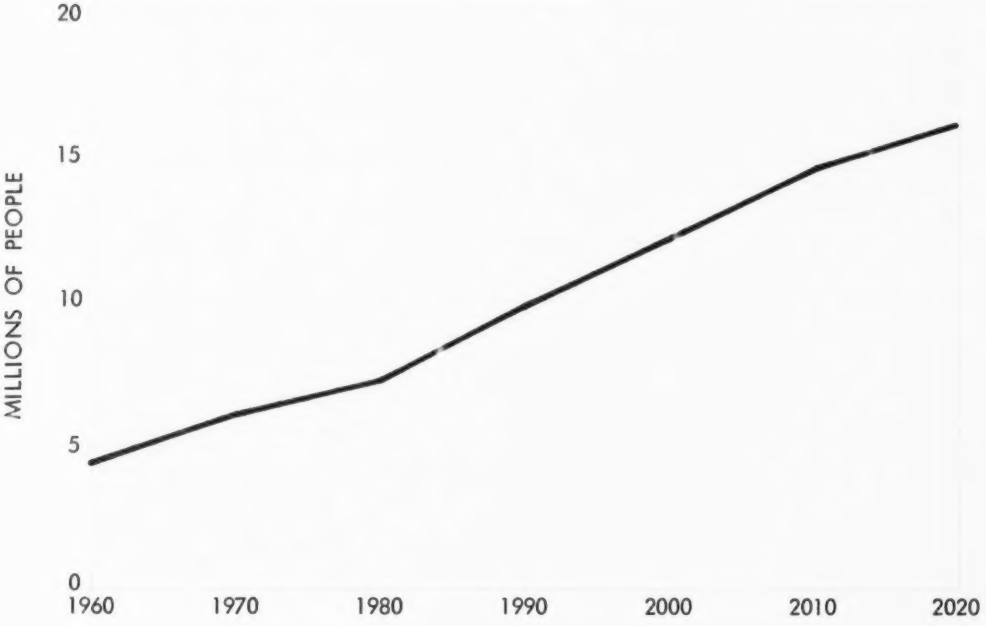
† U.S. Bureau of the Census, California Department of Finance, Department of Water Resources, and Stanford Research Institute. Individual year estimates indentified by source in Table 13.

‡ Excludes California residents.

Preceding page blank

FIGURE 16

MEDIAN POPULATION PROJECTIONS
11 -County Area



STANFORD
RESEARCH
INSTITUTE

Menlo Park
California

Regional Offices and Laboratories

Southern California Laboratories
820 Mission Street
South Pasadena, California 91031

Washington Office
1000 Connecticut Avenue, N.W.
Washington, D.C. 20036

New York Office
270 Park Avenue
New York, New York 10017

Detroit Office
1025 East Maple Road
Birmingham, Michigan 48011

Chicago Office
103 S. Stone Avenue
La Grange, Illinois 60525

Huntsville, Alabama
4810 Bradford Drive, N.W.
Huntsville, Alabama 35805

European Office
Pelikanstrasse 37
Zurich 1, Switzerland

Japan Office
Nomura Securities Building
1-1 Nihonbashidori, Chuo-ku
Tokyo, Japan

Retained Representatives

Toronto, Ontario, Canada
Cyril A. Ing
67 Yonge Street, Room 710
Toronto 1, Ontario, Canada

Milan, Italy
Lorenzo Franceschini
Via Macedonio Melloni, 49
Milan, Italy

Printed in U.S.A. January 1966